Hazardous Waste Combustion Unit Permitting Manual

COMPONENT 7
(Vol. 1 of 2)

How To Prepare Permit Conditions

U.S. EPA Region 6 Center for Combustion Science and Engineering

Tetra Tech EM Inc.

COMPONENT SEVEN

HOW TO PREPARE PERMIT CONDITIONS

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EXHIBITS

ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

acfm	actual cubic feet per minute
ADEM	Alabama Department of Environmental Management
AEI	American Envirotech, Inc.
AFR	Actual feed rate
AGC	Ash Grove Cement
ANCDF	Anniston Chemical Demilitarization Facility
AOC	Area of concern
API	American Petroleum Institute
APCS	Air pollution control system
ASME	American Society of Mechanical Engineers
AWFCO	Automatic waste feed cutoff
BIF	Boiler and industrial furnace
Btu	British thermal unit
°C	Degrees Celsius
CAA	Clean Air Act
cfm	cubic feet per minute
CIF	Consolidated Incineration Facility
Cl_2	Chlorine
CO	Carbon monoxide
40 CFR	Title 40, Code of Federal Regulations
DRE	Destruction and removal efficiency
ESH	Effective stack height
ESP	Electrostatic precipitator
°F	Degrees Fahrenheit
FRSL	Feed rate screening limits
g/hr	grams per hour
gpm	gallons per minute
HAF	Halogen acid furnace
HCl	Hydrogen chloride
HEPA	High efficiency particulate air
HHV	High heating value
HI	Hazard index
HQ	Hazard quotient
HRA	Hourly rolling average
HSWA	Hazardous and Solid Waste Amendments
°K	Degrees Kelvin
KDHE	Kansas Department of Health and Environment
kVA	kilovolt amperes
lb/hr	pounds per hour
lb/min	pounds per minute
lb/yr	pounds per year
LIC	Liquid injection incinerator
LHV	Low heating value
$\mu g/m^3$	micrograms per cubic meter
m^3/sec	cubic meters per second

MEI	Maximum exposed individual

ABBREVIATIONS AND ACRONYMS
(Continued)

NFPA	National Fire Protection Association
O_2	Oxygen
PCC	Primary combustion chamber
PCDD/PCDF	Polychlorinated dibenzo(p)dioxin/polychlorinated dibenzofuran
PIC	Product of incomplete combustion
PLC	Programmable logic controller
PM	Particulate matter
POHC	Principal organic hazardous constituent
ppmv	parts per million bay volume
psia	pounds per square inch absolute
psig	pounds per square inch gauge
RAC	Reference air concentration
RCRA	Resource Conservation and Recovery Act
RSD	Risk specific dose
SCC	Secondary combustion chamber
SCDHEC	South Carolina Department of Health, Environment, and Conservation
SWMU	Solid waste management unit
TAESH	Terrain adjusted effective stack height
THC	Total hydrocarbon
TID	Technical Implementation Document
TNRCC	Texas Natural Resource Conservation Commission
tph	tons per hour
TXI	Texas Industries, Inc.
U.S. EPA	U.S. Environmental Protection Agency
w.c.	Water column

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1.0 INTRODUCTION

Regulations: Tittle 40 Code of Federal Regulations (CFR) Parts 124, 264.344, 270.1, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual**.**

Explanation: As part of the permit process, the permit writer must include the applicable set of operating requirements specific to each type of hazardous waste that will be burned and the operating modes of the combustion unit permit conditions. The subsections of this introductory section address:

- The typical permit (Section 1.1)
- The permit process (Section 1.2)
- The four-phased process for new facilities (Section 1.3)
- The permitting team (Section 1.4)

The actual permit process followed depends on whether the permit is for a new or existing hazardous waste combustion unit. For either case, the operating requirements must reflect the range of conditions that have been successfully demonstrated during the trial burn. Because the permits are for complex waste management facilities, a diverse team of professionals is required to prepare the operating permit.

Check For: The typical operating permit includes the following sections:

- ❑ Module I—Standard Permit conditions
- ❑ Module II—General Facility Conditions
- ❑ Module III—Storage in Containers
- ❑ Module IV—Storage in Tanks
- ❑ Module V—Miscellaneous Units
- ❑ Module VI—General Operating Requirements
- ❑ Module VII—Specific Operating Conditions
- ❑ Module VIII—Corrective Action
- ❑ Module IX—Closure and Financial Assurance

Sections 2.0 through 10.0 of this component discuss the various modules of an operating permit. This component also includes an explanation of how to develop permit conditions (Section 5.0) and a case study (Section 11.0).

Example Situation: Lois and Clark receive a Part B permit application for a new hazardous waste combustion unit. What do they do?

Example Action: Because the ultimate goal of the combustion unit permitting process is the development of a permit and operating permit conditions that satisfies the facility, the regulatory agency, and the public; Lois and Clark review Component 7 to ensure they understand the full scope of the information needed to prepare the permit.

Notes: ____
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1.1 THE TYPICAL PERMIT

Regulations: 40 CFR Parts 264.344, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: No required format exists for a hazardous waste combustion system permit. The permit must, however, designate a set of operating requirements specific to each type of hazardous waste that will be burned in the unit. These operating requirements must reflect the set of conditions that have been shown during the trial burn to achieve applicable performance standards and operating requirements of 40 CFR Parts 264.343 and 264.345. The permit may also specify compliance schedules that require facilities to meet current operating standards and stipulate corrective actions for existing solid waste management units (SWMU) with documented releases.

Examples: Lois and Clark of Metropolis have been selected to prepare permit conditions for several facilities including the following:

<u>Anniston Chemical Demilitarization Facility, Anniston, Alabama</u>

The Alabama Department of Environmental Management (ADEM) issued a final Resource Conservation and Recovery Act (RCRA) permit in June 1997 (Permit AL3 210 020 027, see Attachment A) for Anniston Chemical Demilitarization Facility (ANCDF). ANCDF is an integrated hazardous waste management system for chemical weapons and includes tank storage systems, several evaporators, four different incinerators and furnaces, and associated air pollution control systems (APCS). Lois and Clark organized the ANCDF draft permit as follows:

Module I	Standard Permit Conditions
Module II	General Facility Conditions
Module III	Container Storage
Module IV	Tank Systems
Module V	Miscellaneous Treatment Units
Module VI	Incineration — Shakedown, Trial Burn, and Post-Trial Burn
Module VII	Incineration— Normal Operation
Module VIII	Corrective Action for Solid Waste Management Units

Texas Industries, Inc., Midlothian, Texas

The Texas Natural Resource Conservation Commission (TNRCC) in 1996 issued a draft RCRA permit governing Texas Industries, Inc. (TXI), governing the operation of hazardous waste storage tanks and waste-burning kilns at its cement plant in Midlothian, Texas (see Attachment B). Lois and Clark organized the TXI draft RCRA permit as follows:

Permit Section I - General Permit Conditions
Permit Section II - General Facility Conditions
Permit Section III - Storage in Containers
Permit Section IV - Storage and Processing in Tanks
Permit Section V - Office of Air Quality Provisions
Permit Section VI - Closure and Financial Assurance Requirements
Permit Section VII - Corrective Action Requirements

EPA Region 6 Model Permits

To provide guidance to permit writers regarding the format and content of permits, EPA Region 6 has developed model boiler and industrial furnace (BIF) Hazardous and Solid Waste Amendments (HSWA) permits for four types of hazardous waste combustion systems: boilers, rotary kiln incinerators, cement kilns, and halogen acid furnaces. These model permits are provided in Attachments C, D, E, and F.

Notes: ____

1.2 THE PERMIT PROCESS

Regulations: 40 CFR Parts 124 and 270.1

Guidance: No specific references are applicable to this section of the manual.

Explanation: There are prescribed processes for permitting new and existing hazardous waste incinerators and BIFs. The permit for a new facility must be issued before construction of that unit may begin. Existing facilities operating under interim status will be issued a permit after completion of the trial burn test.

Check For: Whether the facility is new or existing, there are fundamental elements associated with the permitting process. The following summarizes the process elements common to both types of facilities.

New Facilities

❑ Submit Part A permit application

❑ Submit Part B permit application

❑ Review permit application

❑ Prepare draft permit

❑ Public participation

  ❑ Public Participation Rule notices and informal meeting
  ❑ Public comment on draft permit
  ❑ Public hearing or meeting (if requested)

❑ Issue four-phased permit

❑ Phase 1 - startup/shakedown

❑ Phase 2 - trial burn

❑ Phase 3 - post-trial burn operations

❑ Phase 4 - final operating conditions

Existing Facilities

- ❑ Submit Part A permit application
- ❑ Submit Part B permit application
- ❑ Review permit application
- ❑ Public comment on trial burn plan (optional)
- ❑ Trial burn
- ❑ Trial burn analysis and review
- ❑ Prepare draft permit
- ❑ Public participation
    - ❑ Public Participation Rule notices and informal meeting
    - ❑ Public comment on draft permit
    - ❑ Public hearing or meeting (if requested by public)
- ❑ Issue permit

Examples: In preparing permit conditions for the following facilities, Lois considered information generated during the following sequence of events. Lois is satisfied that these events, and the order in which they occur, address all necessary permitting process elements.

New Facility

Parts A and B permit application prepared - January 1994
State agency review of permit application - April 1994
U.S. EPA review of permit application - June 1994
Draft permit issued - January 1995
Public notice of draft permit - January 1995
Public hearing - March 1995
Four-phased permit issued - July 1996
Four-phased permit revised - September 1996
` Trial burn - October 1996
Final operating conditions (expected) - January 1997

Existing Facility

Parts A and B permit application prepared - May 1995
U.S. EPA review of permit application - June 1995
Trial burn - November 1995
Draft permit issued - January 1996
Public comment - January 1996
Public hearings (two) - February 1996
Final permit issued - August 1996

Notes:

1.3 THE FOUR-PHASED PROCESS FOR NEW FACILITIES

Regulations: 40 CFR Part 270.62

Guidance: No specific references are applicable to this section of the manual.

Explanation: The permit for a new hazardous waste combustion unit covers four phases of the facility's life cycle. The following is a discussion of the four phases. They are further discussed in Component 1—How to Review a Trial Burn Plan, and Component 6—How to Review a Trial Burn Report.

Required Phases:

- <u>Phase 1 - Startup/Shakedown</u>. This phase allows limited waste burning to help stabilize the new facility's operation. During startup and shakedown, waste feed rates typically are limited to anticipated final limits. In practice, startup and shakedown occur sequentially. The startup period occurs after construction is complete, as shown on Exhibit 1.3-1 (see page 7-11). During startup, a team of construction and operations personnel "systemizes" the new plant by conducting tests on discrete subsystems (waste blending, waste feed, combustion, air pollution control) using nonhazardous feed materials. Any firing during this period involves either fossil fuels or surrogate waste forms. To conclude startup, an integrated systems test is usually conducted—again using only fossil fuels or surrogates. If the integrated test is a success, the construction team turns the new plant over to operations and the shakedown period commences.

  During shakedown, the new plant is operated while burning hazardous wastes. Generally, waste feed rates are low during the initial hours of shakedown. Waste feed rates are gradually raised to anticipated final limits over the duration of the shakedown.

  The initial shakedown period is limited by regulation to a maximum of 720 hours while burning hazardous wastes. Shakedown testing may reveal major problems in system design (improperly sized feed augers for solid wastes or inadequate atomization of waste, for example). These problems may require significant changes to the system. In such cases, it may be impossible to complete shakedown testing in 720 hours. To account for such possibilities, regulations allow the facility owner to petition EPA for an extension of the shakedown period. Under current regulations, EPA may grant the facility a *single* extension of no more than 720-hours. EPA Region 6 policy allows for no more than two 720 hour shakedown periods.

- <u>Phase 2 - Trial Burn</u>. This phase allows waste burning for the duration of the trial burn (usually several weeks or less) to monitor emissions and process operations and to assess compliance with performance standards. The trial burn is used to establish final permit limits for the facility. Accordingly, waste feed rates during the trial burn are 100 percent of anticipated final limits.

- Phase 3 - Post-Trial Burn Operations. Under this phase, the combustion unit system may operate under specified limits for several months while trial burn results are reviewed. Permit writers normally constrain post-trial burn operations to waste feed rates lower than were demonstrated during the trial burn. Post-trial burn waste feed rates commonly are 50-90 percent of the waste feed rates demonstrated during the trial burn. TNRCC, for example, typically limits waste feed rates to 90 percent during the post-trial burn period.

- Phase 4 - Final Operating Conditions. If the combustion unit system meets performance standards, final permit conditions are issued governing operations for a prescribed period (usually 10 years or less). The feed rate limits imposed by the final permit typically are those demonstrated during the trial burn. As described in Section 5.3.4, however, final permitted waste feed rates may be reduced to account for the results of the site-specific risk assessment.

  Regarding the risk assessment, it is recommended that a screening risk assessment based on engineering estimates of emissions be completed early in the permitting process (before the trial burn) to provide some basis for anticipated final permit limits. A comprehensive multipathway risk assessment should then be conducted after the trial burn, using trial burn results, to confirm final permit limits.

Examples: **Consolidated Incineration Facility, Aiken, South Carolina**

South Carolina Department of Health, Environment, and Conservation (SCDHEC) issued a four-phased permit in November 1996 for Consolidated Incineration Facility (CIF), a new radioactive mixed waste incineration facility (see Attachment G). Clark included in permit conditions a requirement for the facility to conduct a comprehensive trial burn, including extensive testing for products of incomplete combustion (PIC) for risk assessment purposes. The trial burn was completed in April 1997. SCDHEC expects to issue final permit limits within 6 months. Refer to Attachment Q for Phase 3 (post-trial burn permit conditions). The CIF permit is unusual in that the limitations on waste feed rates in the shakedown, trial burn, and post-trial burn periods are the same.

Anniston Chemical Demilitarization Facility, Anniston, Alabama

ADEM, with the cooperation of the National Chemical Demilitarization Work Group, prepared a four-phased permit for the chemical weapons incineration complex to be constructed at Anniston, Alabama. Lois included in the permit conditions a requirement for extensive PIC testing for risk assessment purposes. See Attachment A for an advance copy of the final permit.

The permit for the Anniston incinerator is typical in that the permitted limits on waste feeds during the shakedown period are the same as trial burn limits. Limits for the post-trial burn period are initially 50 percent of the maximum and phased up to 100 percent after the trial burn report and risk assessment are submitted. Refer to Module VI, Section C.2 of the Anniston permit for specific permit language (see Attachment A).

EPA Region 6 Model Permits

In the EPA Region 6 model permits, waste feed rates in the startup and shakedown and post-trial burn periods have been reduced from anticipated final permitted levels. This percent reduction is at the discretion of the permit writer.

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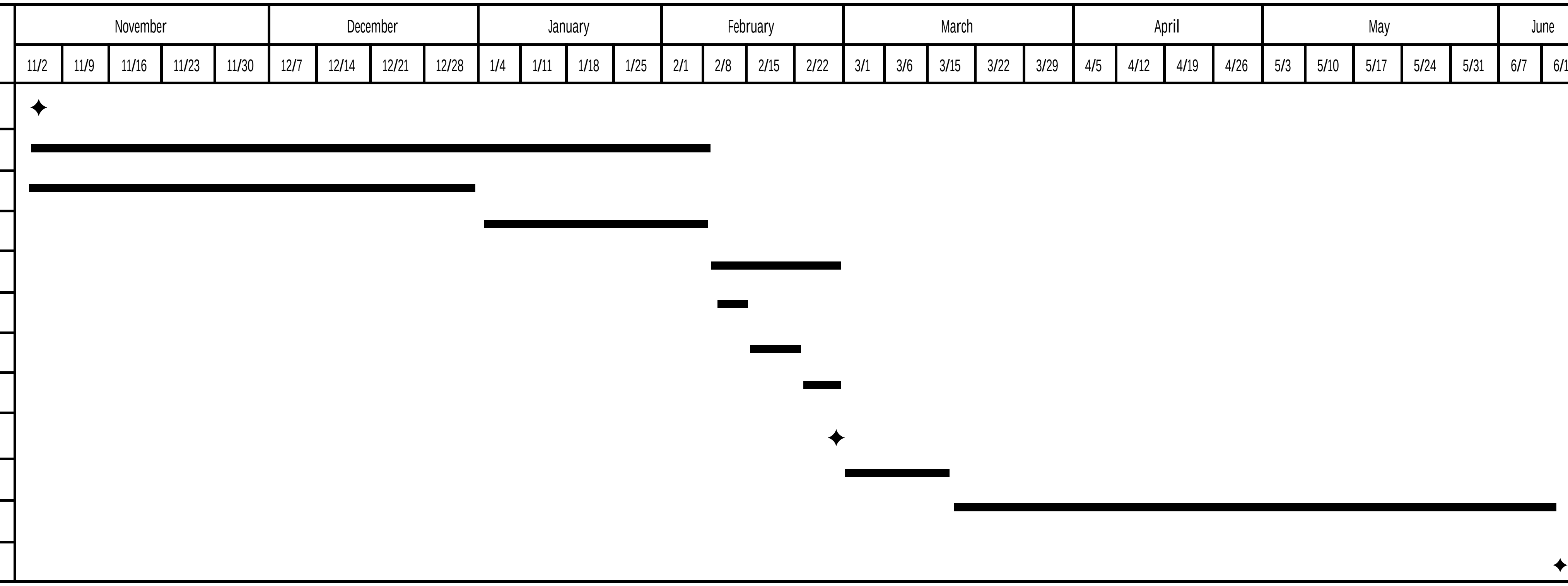
EXHIBIT 1.3-1
EXAMPLE TESTING AND TRIAL BURN SCHEDULE

ID	Task Name	Duration	Start	Finish
1	**COMPLETE CONSTRUCTION/PROJECT TURNOVER**	1d	Mon 11/3/97	Mon 11/3/97
2	**START UP TESTING**	91d	Tue 11/4/97	Mon 2/2/98
3	SYSTEMS TEST	60d	Tue 11/4/97	Fri 1/2/98
4	INTEGRATED SYSTEMS TEST	29d	Mon 1/5/98	Mon 2/2/98
5	**SHAKEDOWN TESTING**	24d	Tue 2/3/98	Thu 2/26/98
6	10% WASTE CAPACITY TEST	8d	Tue 2/3/98	Tue 2/10/98
7	50% WASTE CAPACITY TEST	8d	Wed 2/11/98	Wed 2/18/98
8	100% WASTE CAPACITY TEST	8d	Thu 2/19/98	Thu 2/26/98
9	**OPERATIONAL READINESS**	1d	Fri 2/27/98	Fri 2/27/98
10	**TRIAL BURN**	15d	Mon 3/2/98	Mon 3/16/98
11	**TRIAL BURN DATA EVALUATION/REPORT PREPARATION**	88d	Tue 3/17/98	6/12/98
12	**TRIAL BURN REPORT SUBMITTAL**	1d	Mon 6/15/98	Mon 6/15/98



1.4 THE PERMITTING TEAM

Regulations: No regulations are applicable to this section of the manual.

Guidance: No specific references are applicable to this section of the manual.

Explanation: The hazardous waste combustion process is normally one element of a complex waste management facility that is being permitted. Preparation of a permit for the facility will require a mix of project management, regulatory compliance, technical, and public relations skills. Accordingly, most permits are written by a diverse team of professionals. The following is a list of professional skills that will be required to support the permit preparation process for combustion units.

Recommended Skills:

- Public relations
- Environmental law
- Regulatory compliance
- Policy specialist
- Structural analysis
- Material science
- Fluid flow
- Material handling
- Combustion processes
- Stack sampling
- APCS operation and design
- Air dispersion and ground deposition modeling
- Ecological risk assessment
- Human health risk assessment
- Environmental remediation

Example Situation: Lois and Clark are required to manage permit preparation for the following facilities. Each facility has several units to be addressed in the permit.

Ash Grove Cement, Chanute, Kansas

Ash Grove Cement (AGC) operates two hazardous waste-burning cement kilns at Chanute, Kansas. These kilns burn a variety of organic hazardous waste liquids and solids received from off-site generators, including solvent still bottoms, ink waste oils, and other materials. The facility is permitted to handle hazardous wastes with more than 400 D, F, K, P, and U waste codes. The Kansas Department of Health and Environment (KDHE) and EPA Region 7 issued final permits for waste storage in tanks and containers and incineration in cement kilns in 1996.

Additionally—like many newer permits—this permit contains requirements for corrective actions. For the AGC permit, Lois included corrective action provisions covering 24 SWMUs and several areas of concern (AOCs), including tank farms, secondary containment basins, sumps, chemical storage areas, landfills, and other units.

Anniston Chemical Demilitarization Facility, Anniston, Alabama

The ANCDF is an integrated treatment complex for chemical weapons located at the Anniston Army Depot in Alabama. This facility is under construction. When completed, it will house 12 different hazardous waste storage and treatment units, including a liquid waste incinerator for bulk chemical agent; a deactivation furnace for energetics; a brine (process wastewater) storage tank system; two brine evaporators; two brine drum dryers; a metal parts furnace for ordnance casings; a dunnage incinerator; a bulk chemical agent storage tank system; a container storage building; and a tank system for spent decontamination liquids.

Hazardous wastes to be managed at the facility include a variety of VX-, GB-, HD-, and HT-based chemical weapons, including M55 rockets and artillery shells.

Examples: To complete permit preparation, Lois and Clark, recognized that they would need a team of professionals with various expertise. To complete a permit for each facility, Lois and Clark assembled the following professionals for each facility. Key personnel involved in writing the permits were as follows:

Ash Grove Cement, Chanute, Kansas

Tank and Container Systems
Two Engineers, KDHE

Incineration Systems

Chemical Engineer, EPA

Corrective Actions
Civil Engineer, EPA

General Requirements
U.S. EPA legal counsel

Anniston Chemical Demilitarization Facility, Anniston, Alabama

Incineration Systems, ADEM
Engineer

National Chemical Demilitarization Work Group
See Attachment H

Notes: ____

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2.0 STANDARD PERMIT CONDITIONS

Regulations: 40 CFR Part 270.30

Guidance: No specific references are applicable to this section of the manual.

Explanation: These permit conditions are applicable to all facilities:

Duty to comply - compels the permittee to comply with all conditions of the permit.

Duty to reapply - compels the permittee to reapply for a permit after the current permit expires.

Need to halt or reduce activity not a defense - compels the permittee to halt or reduce the permitted activity, if necessary, to maintain compliance with permit conditions.

Minimize releases to the environment - compels the permittee to take steps to minimize releases to the environment during a period of noncompliance with permit conditions.

Proper operation and maintenance - requires the permittee to properly operate and maintain the facility at all times.

Permit action - allows the regulatory agency to modify, revoke, reissue, or terminate the permit for cause.

Property rights - no property rights or exclusive privilege are conveyed by the permit.

Duty to provide information - requires the permittee to furnish to the regulatory agency any requested, relevant information.

Inspection and entry - guarantees the regulatory agency entry, access, and inspection to the facility.

Monitoring and records - requires the permittee to prepare and retain records of all monitoring activities for at least 3 years.

Signatory requirements - requires the permittee to sign and certify all applications, reports, or other documents submitted to the regulatory agency.

Reporting requirements - sets forth specific requirements for reporting planned changes, anticipated noncompliance, transfers, monitoring results, compliance schedules, 24-hour reports, manifest discrepancy reports, unmanifested waste reports, biennial reports, and other information.

Information repository - allows the regulatory agency to require the permittee to establish and maintain an information repository.

Recording and reporting of monitoring results - specifies the installation and use of monitoring equipment, and associated reporting requirements.

Examples:

Texas Industries, Inc., Midlothian, Texas

Clark incorporated the above requirements in preparing draft standard permit conditions for TXI (see Attachment I). The TXI draft RCRA permit exemplifies the approach in which general permit conditions promulgated in regulations are reiterated in the permit. The benefit of this approach is that all requirements are clearly defined in the report. The primary drawback is that it produces a voluminous permit. The TXI draft RCRA permit is an example of an approach in which standard permit requirements promulgated in regulation are incorporated into the permit by reference (see Permit Section I.F. in Attachment I) and additional facility-specific conditions are stipulated in detail. This approach is attractive because it makes the permit more concise and usable as a field inspection/compliance tool. The drawback from this approach is that it requires inspectors/auditors to refer back to the regulatory requirements if they are not well-versed with the regulations.

Anniston Chemical Demilitarization Facility, Anniston, Alabama

These requirements comprise an integral portion of both draft and final permits, and it is standard practice for these requirements to be included as permit conditions (see Attachment J). Clark incorporated the above requirements in preparing standard permit conditions for this facility.

The ANCDF permit illustrates the approach in which regulatory requirements are reiterated verbatim. The benefit of this approach is that all requirements are explicit. The primary drawback is the voluminous nature of the permit.

EPA Region 6 Model Permits

The approach recommended by EPA Region 6 is similar to that adopted by TNRCC in the TXI draft RCRA permit. Regulatory requirements are incorporated by reference and facility-specific conditions are stipulated in detail. Refer to Attachments C, D, E, and F for examples.

Notes: ____

3.0 GENERAL FACILITY CONDITIONS

Regulations: 40 CFR 270.30

Guidance: No specific references are applicable to this section of the manual.

Explanation: These general permit conditions are applicable to all hazardous waste combustion facilities:

Design and operation of facility - compels the permittee to design, construct, and operate the permitted facility in accordance with engineering designs and specifications and in a manner that minimizes hazards to human health and the environment.

Restrictions on off-site wastes - places restrictions or prohibitions on the receipt of wastes from off-site generators.

General waste analysis - compels the permittee to follow the requirements of the approved waste analysis plan and prohibits the acceptance of waste for storage or treatment that has not been completely characterized. A copy of the approved waste analysis plan is typically attached to the permit.

Security procedures - compels the permittee to maintain fencing and security and to prevent unauthorized entry to the site.

General inspection requirements - requires the permittee to implement an approved inspection program. A copy of the approved inspection program is typically attached to the permit.

Training plan - requires the permittee to implement a hazardous waste management training program for personnel involved in the management of hazardous waste.

Preparedness and prevention - compels the permittee to implement the approved preparedness and prevention program, and maintain and repair equipment to prevent hazards to human health and the environment.

Contingency plan - compels the permittee to follow its approved contingency plan, and forbids the permittee from operating the facility following an incident requiring contingency plan activation until all emergency equipment and resources are again in place and functional.

Recordkeeping and reporting - requires the permittee to maintain a written operating record and to file reports required under the regulations and the permit.

Closure - requires the permittee to maintain an updated closure plan, including a closure cost estimate, and to close the site according to the approved closure plan.

Financial assurance - requires the permittee to maintain financial assurance for the facility.

Liability - sets forth specific requirements for maintaining liability insurance.

Risk assessment requirements - requires the permittee to conduct a risk assessment, usually according to an approved risk assessment work plan, within a specified period of time following completion of the facility's trial burn.

Air emission standards for equipment leaks - places limits on emissions of hazardous waste constituents from storage vessels and piping systems.

Waste minimization - compels the permittee to implement a program designed to reduce the volume and toxicity of hazardous wastes.

Land disposal restrictions - requires the permittee to comply with land disposal restrictions.

Examples: Lois incorporated the above requirements in preparing general permit conditions for ANCDF, a hazardous waste combustion facility (see Attachment K). The approach at ANCDF involved incorporating regulatory requirements by reference (see Section II.c of Attachment K, for example) and stipulating numerous facility-specific permit conditions. Regarding the latter, all of the permit conditions listed are facility specific. The practice of incorporating regulatory requirements by reference allowed the permitting authority to stipulate all of the general permit conditions in 11 pages of text. Had the permitting authority opted to reiterate regulatory requirements verbatim in the permit, the length of this permit section would have increased substantially.

These requirements comprise an integral portion of both draft and final permits, and it is standard practice for these requirements to be included as permit conditions.

Notes: ____

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4.0 CONDITIONS APPLICABLE TO CONTAINERS AND TANKS

Regulations: 40 CFR Parts 264 Subparts I, J, and CC; 270.15; and 270.16

Guidance: No specific references are applicable to this section of the manual.

Explanation: These permit conditions are applicable to container and tank systems located at hazardous waste combustion facilities:

Containers

Permitted and prohibited wastes - the permit typically specifies by name and waste code the list of wastes that can be managed in the container system and wastes that are expressly prohibited.

Waste volume - the permit usually specifies the maximum quantity of waste that may be placed in each storage or treatment unit at any one time.

Operation and maintenance - compels the permittee to operate and maintain the containers in accordance with approved procedures, usually those presented in Section D of the permit application, and to keep all containers closed during storage.

Container condition - compels the permittee to store wastes only in containers that are in good condition.

Waste compatibility - requires the permittee to use only containers that are made of, or lined with, materials that are compatible with the wastes.

Containment system - requires the permittee to store containers filled with wastes in containment systems that meet the retention volume and compatibility requirements of 40 CFR Part 264.175, and to remediate and report spills.

Inspection program - requires the permittee to implement an approved program of container inspections.

Recordkeeping - requires the permittee to place the results of waste analysis and compatibility tests in the operating record and to maintain accurate written inventories of wastes managed in containers.

Special requirements for ignitable or reactive wastes - requires the permittee to store ignitable or reactive wastes at least 50 feet from the property line and to implement procedures, usually those presented in Section F of the permit application, to prevent fires and explosions involving these materials.

Special requirements for incompatible wastes - requires the permittee to segregate incompatible wastes and to implement procedures, usually those presented in Section F of the permit application, to prevent commingling of these materials.

Tanks

Design standards - requires that tanks comply with applicable design standards, such as American Petroleum Institute (API) 650 or American Society of Mechanical Engineers (ASME) Pressure Vessel Code Section VIII.

Permitted and prohibited wastes - the permit typically specifies by name and waste code the list of wastes that can be managed in the tank system and wastes that are expressly prohibited.

Waste volume - the permit usually specifies the maximum quantity of waste that may be placed in each storage or treatment unit at any one time.

Operation and maintenance - compels the permittee to operate and maintain the tanks in accordance with approved procedures, usually those presented in Section D of the permit application, and to prevent spills, overflows, or other types of releases from the tanks.

Response to leaks or spills - compels the permittee to take specific response actions to leaks or spills, including reporting.

Waste compatibility - requires the permittee to place only those wastes that are compatible with construction materials into tank systems.

Containment system - requires the permittee to maintain containment systems that meet retention volume and compatibility requirements of 40 CFR Part 264.193.

Inspection program - requires the permittee to implement an approved program of tank system inspections, including tank integrity assessments and certifications.

Recordkeeping - requires the permittee to place the results of waste analysis and compatibility tests in the operating record and to maintain accurate written inventories of wastes managed in the tank system.

Special requirements for ignitable or reactive wastes - requires the permittee to store ignitable or reactive wastes a protective distance from the property line; to comply with National Fire Protection Association (NFPA) requirements; and to implement procedures, usually those presented in Section F of the permit application, to prevent fires and explosions involving these materials.

Special requirements for incompatible wastes - requires the permittee to segregate incompatible wastes and to implement procedures, usually those presented in Section F of the permit application, to prevent commingling of these materials.

Examples: Lois incorporated the above tank and container requirements in preparing permit conditions for the AGC facility (see Attachment L). In this case, EPA Region 7 elected to use the incorporation-by-reference approach. Referring to the example, observe that nearly every paragraph begins with "The Permittee shall operate and maintain the ..... in accordance with 40 CFR 264, Subpart..." By utilizing the approach, EPA Region 7 made this section of the permit comprehensive, yet concise.

Notes: ____
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5.0 DEVELOPING PERMIT CONDITIONS

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: Limits on operating conditions fall into three groups of parameters, as follows:

- Group A. Permit limits for control parameters that are critical to system performance are established on the basis of trial burn results and are interlocked with the automatic waste feed cutoff (AWFCO) system
- Group B. Control parameters for which permit limits are established on the basis of trial burn results but are not interlocked with the AWFCO system
- Group C. Control parameters for which permit limits are established on design considerations, good engineering practices, and equipment manufacturers' recommendations; some Group C parameters may be interlocked with the AWFCO system

Check For: The following subsections, 5.1 through 5.3, explain how these conditions are established.

- ❑ Evaluating trial burn data
- ❑ Permitting approaches
- ❑ Developing permit limits

Example Situation: AGC burns hazardous wastes in two cement kilns at Chanute, Kansas. The principal components of the waste combustion trains are feed systems, rotary kilns, and electrostatic precipitators. In the AGC kiln permit, Clark included operating limits for the following Group A, B, and C parameters (see Attachment M):

Group A

- Carbon monoxide (CO) in stack gas
- Total hydrocarbons (THC) in stack gas
- Minimum combustion temperature
- Maximum combustion temperature

- Maximum feed rate of pumpable hazardous waste
- Maximum total feed rate of hazardous waste
- Maximum feed rate of dry raw material (surrogate for maximum production rate)
- Maximum stack gas flow rate
- Minimum electrical power to electrostatic precipitator (ESP)
- Maximum ESP inlet temperature

Group B

- Maximum metals feed rates
- Maximum chlorine (Cl_2) feed rate

Group C

- Minimum kiln differential pressure
- Maximum firing hood pressure

Example Action: In Exhibit 5.0-1, (see page 7-24), the rationale for stipulating the permit conditions listed above (for example, “required by regulation” or “needed to maintain process control”) and the basis for the limits (trial burn results, engineer judgment, regulatory mandate, manufacturers’ recommendations) are provided.

Notes: ______________________________

EXHIBIT 5.0-1

PERMIT CONDITION RATIONALE AND BASIS

Condition	Rationale	Basis
Group A—Maximum CO in stack gas	Required by regulation 40 CFR 266.104 (c)	Trial burn results
Group A—THC in stack gas	Required by regulation 40 CFR 266.104 (c)	Trial burn results
Group A—Minimum combustion temperature	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Maximum combustion temperature	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Maximum feed rate of pumpable hazardous waste	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Maximum total feed rate of hazardous waste	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Maximum feed rate of dry raw materials	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Maximum stack gas flow rate	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Minimum electrical power to ESP	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group A—Maximum ESP inlet temperature	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group B—Maximum Cl_2 feed rates	Required by regulation 40 CFR 266.102 (e)	Trial burn results
Group B—Maximum metals feed rates	Required by regulation 40 CFR 266.102(e)	Trial burn results
Group C—Maximum kiln differential pressure	Required by regulation 40 CFR 266.102 (e)	Engineering judgment
Group C—Maximum firing hood pressure	Required by regulation 40 CFR 266.102 (e)	Engineering judgment

5.1 EVALUATING TRIAL BURN DATA

Regulations: No regulations are applicable to this section of the manual.

Guidance: No specific references are applicable to this section of the manual.

Explanation: The permit writer should thoroughly evaluate all trial burn data, including both process emissions and operating conditions, before expending substantial time and effort on developing permit conditions. This evaluation should be based on a disciplined systems perspective and designed to accomplish two primary objectives:

- Highlight underlying trends and variability in the trial burn data

- Uncover interdependencies and causal relationships between process operating conditions and emissions

As a first step in this evaluation, the permit writer should plot all available process operating and emissions data to provide visual insights into data trends, variations, and relationships. There may be instances where the facility can provide these data plots so that the permit writer need not be responsible for generating them. This issue should be discussed and resolved as part of trial burn plan deliberations.

Check for: It is recommended that data be plotted in as many formats as appropriate and as time permits. For example, it may be beneficial to plot combustion chamber temperature against time to evaluate temporal variation in that parameter and against stack gas carbon monoxide to evaluate correlations between combustion chamber temperature and PIC formation rates. Data plots should be checked for:

❏ Variations over time
❏ Patterns or trends
❏ Process stability
❏ Relationships between parameters

Example: Lois reviewed the trial burn report prepared by XYZ Chemical Co. for its waste burning boiler. Lois plotted the combustion chamber temperatures measured during the three runs of the risk burn as shown in Exhibit 5.1-1 (see page 7-27).

Upon reviewing the plots, Lois noted the following:

- Combustion temperature was relatively constant during Runs 1 and 2
- Combustion temperature trended steadily upward throughout Run 3

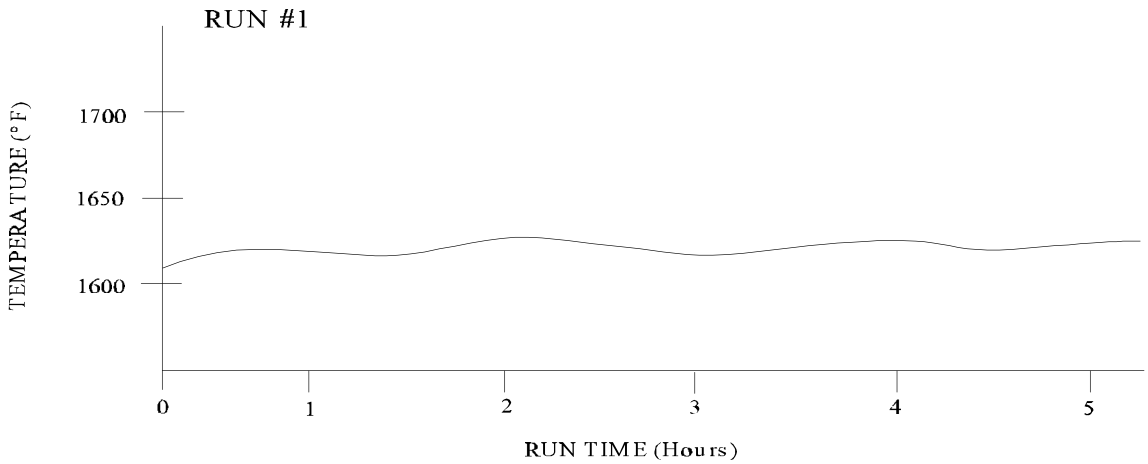
Lois then constructed control charts as shown on Exhibit 5.1-2 (see page 7-28), using plus or minus (+/-) 2 standard deviations as the upper and lower control limits. Referring to these charts, Lois determined the following:

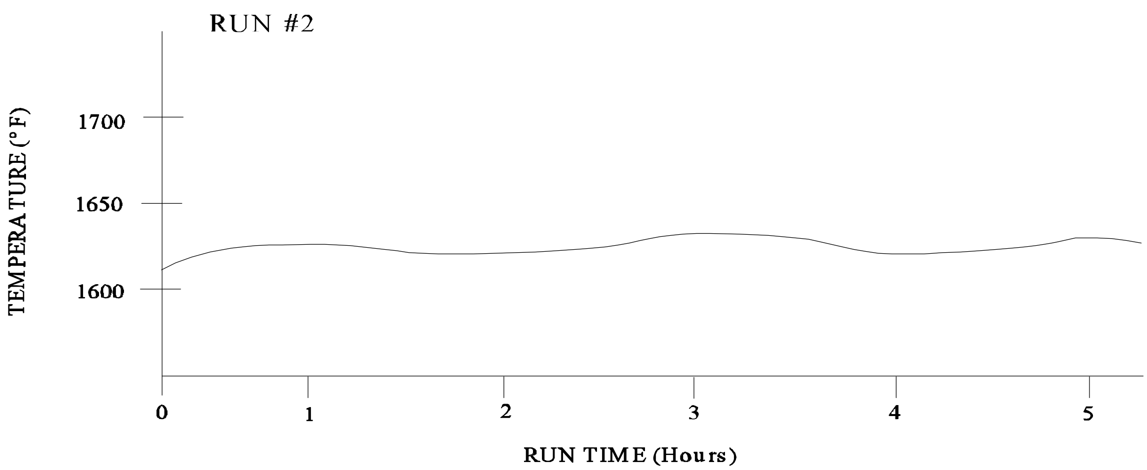
- All data points were within the control limits during Runs 1 and 2, indicating the boiler process was "under control."

- Large segments of the data plot corresponding to Run 3 were outside the control limits, indicating the boiler process was "out of control."

Lois speculated that the third run was not representative of "normal operations" — an underlying requirement for the risk burn. As a follow-up, she examined *the boiler operators' logbook* and noted that the operators experienced problems with the programmable logic controller during the third run. Upon interviewing operators and maintenance personnel, Lois was told that the controller had been in service for 3 years and had never failed before. With all of this information in mind, Lois concluded that the third run was not representative of normal operations. She invalidated the third run and required XYZ Chemical to repeat the third run of the risk burn.

EXHIBIT 5.1-1
COMBUSTION TEMPERATURES OVER TIME





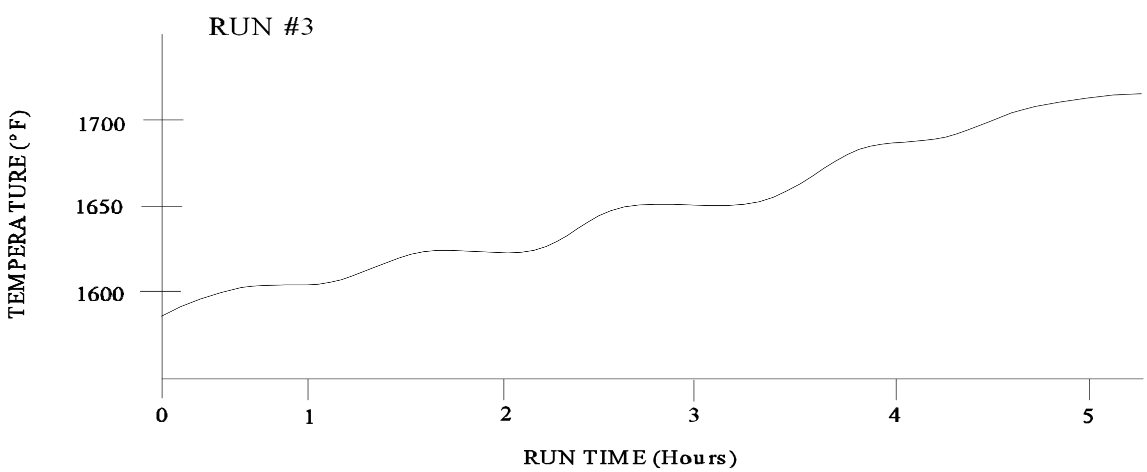
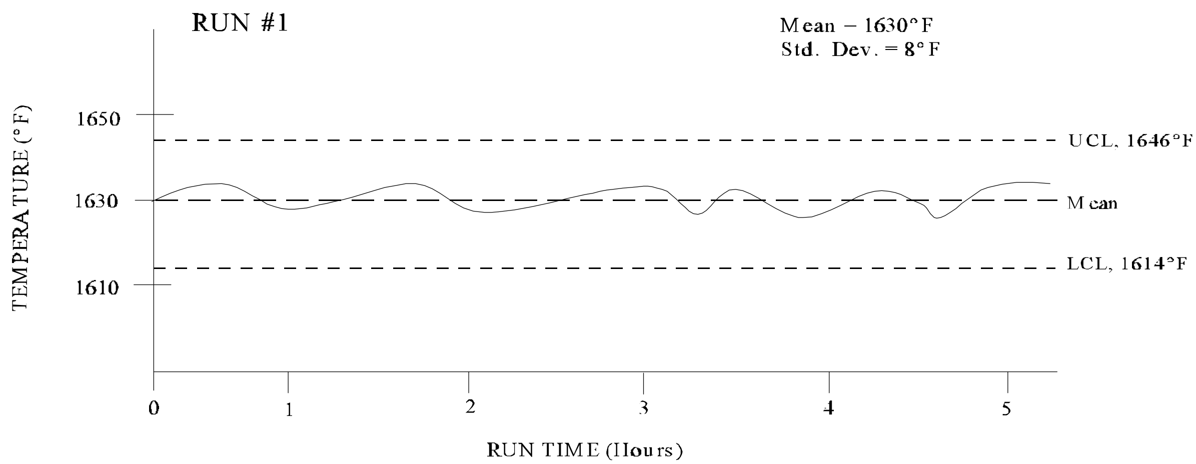
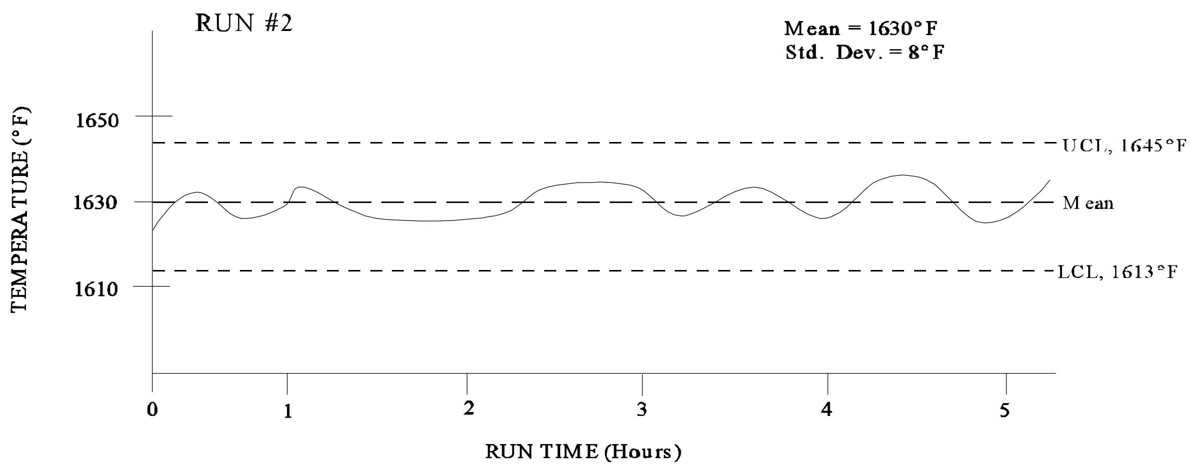
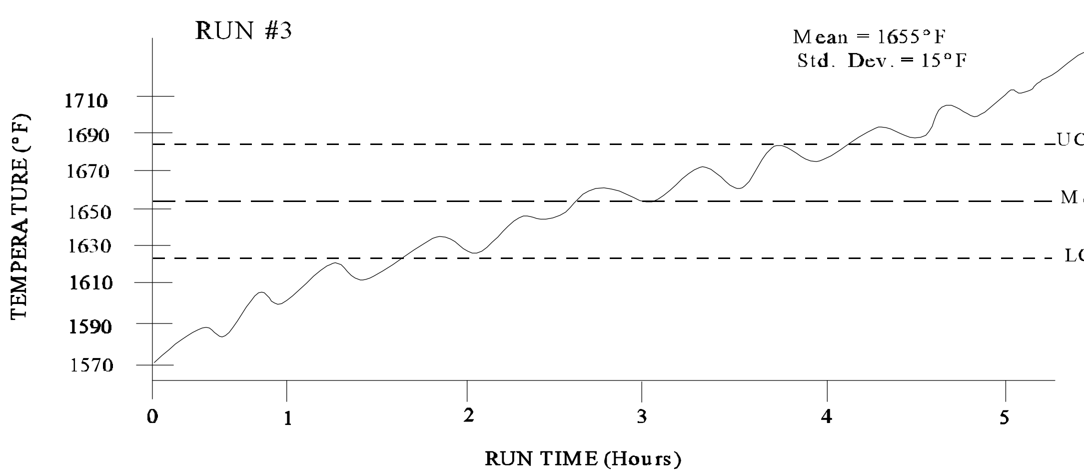


EXHIBIT 5.1-2
COMBUSTION TEMPERATURES CONTROL CHARTS







5.2 SELECTING THE PERMITTING APPROACH

Regulations: No regulations are applicable to this section of the manual.

Guidance: No specific references are applicable to this section of the manual.

Explanation: Three basic permitting approaches exist for a hazardous waste combustion unit facility. The approach is selected based on the complexity of the system being permitted and the desired flexibility of operation.

The following is a discussion of three basic approaches.

Approaches: <u>Basic Permitting Approach</u>

- <u>Single Point</u>. This approach, which is the least complex of the three, is adopted when there is a single type of waste feed and a single set of operating conditions is acceptable. This approach is used most frequently for boilers and liquid-injection incinerators that have a single waste feed stream or only a few chemically similar waste feed streams.

- <u>Multiple Point</u>. This approach is adopted when there are multiple types of waste feeds and multiple operating conditions. This approach is used frequently for rotary kiln hazardous waste incinerators and cement kilns that are burning combinations of chemically dissimilar liquid and solid wastes.

- <u>Universal</u>. This approach is adopted when there are multiple types of wastes burned and a single set of operating conditions is appropriate. Permit conditions under this approach are based on the results of testing during the trial burn with "worst-case" waste mixtures and operating conditions. This approach has been used to permit rotary kiln incinerators, hearth furnaces, and other types of incinerators and BIF units.

Examples: <u>Single-Point Approach</u>. In the American Envirotech, Inc. (A.I.) permit, Clark included a schedule of AWFCO limits that are predicated on the single-point approach (see Exhibit 5.2-1, see page 7-31). The A.I. incineration train, consisting of a rotary kiln and a secondary combustion chamber (SCC), was designed to burn a relatively homogeneous blended hazardous waste which, for all practical purposes, is a single waste feed stream. Cutoff limits specified in Exhibit 5.2-1 (see page 7-31) apply to that single waste stream.

<u>Multiple-Point Approach with Rolling Averages</u>. In the ANCDF draft permit, Lois used a multiple-point permitting approach in the section dealing with the liquid injection incinerator (PIC), which will burn six different liquid materials. Exhibit 5.2-2 (see page 7-32) prescribes separate feed rate limits for each of these materials.

Universal Approach with Both Rolling Average and Instantaneous Limits. The AGC kilns at Chanute, Kansas, burn a variety of solid and liquid hazardous wastes. In the AGC permit, Clark included AWFCO limits that were formulated using the universal approach (see Exhibit 5.2-3, see page 7-33). Note that the limits do not discriminate between various liquid and solid wastes based on waste codes, heat value, chemical composition, or other parameters.

Notes: ____
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EXHIBIT 5.2-1

WASTE FEED CUTOFF LIMITS FOR AMERICAN ENVIROTECH, INC.—SINGLE-POINT APPROACH

The following conditions will automatically cut off all waste feeds to this kiln and the secondary combustion chamber. Each incineration train will work independently for cutoff purposes.

Parameter	Cutoff Limit	Period*
Secondary combustion chamber (SCC) exit temperature	< 1,800 degrees Fahrenheit (°F) rolling hourly average	I, III
	< 1,750°F for any 60-second period	I, III
	< 1,750°F rolling hourly average	II
	< 1,700°F for any 60-second period	II
Loss of the flame in the SCC	Both fire eyes indicating loss	I, II, III
Combustion zones air pressure	≥ Atmospheric pressure for any 60-second period	I, II, III
SCC air pressure	< 2 inches of water for any 60 seconds	I, II, III
SCC differential atomizing pressure		
Air and	< 20 pounds per square inch gauge (pig) for any 60 seconds	I, II, III
Steam	< 20 pig for any 60 seconds	I, II, III
Volumetric flow rate	> 97,000 cubic feet per minute (cfm) at 185°F and 14.7 pounds per square inch absolute (pia) measured at the stack for Any 60 second period	I, II, III
Carbon monoxide concentration in the stack	≥ 100 parts per million by volume (ppmv) rolling hourly average	I, III
	≥ 125 ppmv rolling hourly average	II
	> 1,000 ppmv at any time	I, II, III
Oxygen concentration in the stack	< 3 percent dry volume basis at any time	I, II, III
Quench chamber outlet gas		
Temperature	> 230°F at any time	I, II, III
Water flow rate	< 100 gallons per minute (gpm) for any 60 seconds	I, II, III
Crossflow scrubber		
Flow rate	< 100 gpm for any 60 seconds	I, II, III
Inlet scrubber pH	< 5.0 for any 60 seconds	I, II, III
Tandem nozzle scrubber		
Pressure drop	< 35 inches of water for 30 seconds	I, II, III
Flow rate	< 100 gpm for 60 seconds	I, II, III

Natural gas pressure	< 2 ounces	I, II, III

Notes: Period I = Shakedown
Period II = Trial burn
Period III = Post-trial burn

EXHIBIT 5.2-2

MAXIMUM FEED RATES TO THE ANCDF LIQUID INJECTION INCINERATOR—MULTIPLE POINT APPROACH

Description of Hazardous Wastes	Shakedown/Maximum Post-Trial Burn Hourly Rolling Average	Trial Burn Hourly Rolling Average
Surrogate	1,015 lbs/hour	1,015 lbs/hour
Chemical Agents: VX GB HD HT	 675 lbs/hour 1,015 lbs/hour 1,290 lbs/hour 1,175 lbs/hour	 675 lbs/hour 1,015 lbs/hour 1,290 lbs/hour 1,175 lbs/hour
Decontamination Solution and Monitoring Support Building and Laboratory, Aqueous Liquid Wastes:	2,000 lbs/hour	2,000 lbs/hour
	Shakedown/Maximum Post-Trial Burn One-minute Average (Hourly/60)(1.1)	**Trial Burn One-minute Average (Hourly/60)(1.1)**
Surrogate	19 lbs/minute	19 lbs/minute
Chemical Agents: VX GB HD HT	 13 lbs/minute 19 lbs/minute 24 lbs/minute 22 lbs/minute	 13 lbs/minute 19 lbs/minute 24 lbs/minute 22 lbs/minute
Decontamination Solution and Monitoring Support Building and Laboratory, Aqueous Liquid Wastes:	37 lbs/minute	37 lbs/minute

Notes:

lbs/hour = pounds per hour
lbs/minute = pounds per minute

EXHIBIT 5.2-3

WASTE FEED CUTOFF LIMITS FOR ASH GROVE CEMENT—UNIVERSAL APPROACH

OPERATING PARAMETER	OPERATING CONDITION	RESPONSE TO DEVIATION FROM OPERATING CONDITION	LOCATION OF MONITORING DEVICE
Carbon monoxide	Greater than 600 ppmv (HRA 7% Oxygen dry basis)	Immediate AWFCO	Duct between ESP and exhaust stack
Total hydrocarbons	Greater than 20 ppmv (HRA, 7% dry basis)	Immediate AWFCO	Duct between ESP and exhaust stack
Combustion temperature	Less than 1,622°F (HRA)	Immediate AWFCO	Chain section gas inlet temperature
Combustion temperature	Greater than 2,052°F (HRA)	Immediate AWFCO	Chain section gas inlet
Pumpable hazardous waste	Greater than 5.1 tons per hour (tph) (HRA)	Immediate AWFCO	Hazardous waste feed line on burner floor
Total hazardous waste feed	Greater than 7.1 tph (HRA)	Immediate AWFCO	Hazardous waste feed line on burner floor and container feed
Dry raw material feed	Greater than 65 or less than 42 tph (HRA)	Immediate AWFCO	Raw material slurry feed line
Stack flow	Greater than 1.07 relative flow (HRA)	Immediate AWFCO	Induced draft fan
ESP power	Less than 44.1 kVA (HRA)	Immediate AWFCO	ESP voltage controller
Kiln differential pressure	Greater than -1.0 in. w.c.	Immediate AWFCO	Pressure taps at feed end and burner hood
Firing hood pressure	Greater than 0.01 in. w.c.	Immediate AWFCO	Pressure tap at burner hood
ESP inlet temperature	Greater than 388°F (HRA)	Immediate AWFCO	ESP inlet

Notes:

AWFCO = Automatic waste feed cutoff
ESP = Electrostatic Precipitator
HRA = Hourly rolling average
kVA = kilovolt Ampere
w.c. = Water column
ppmv = parts per million by volume
ºF = degrees Fahrenheit
tph = tons per hour

5.3 DEVELOPING PERMIT LIMITS

Regulations: No regulations are applicable to this section of the manual.

Guidance: No specific references are applicable to this section of the manual.

Explanation: Permit limits for control parameters may be established based on instantaneous values, rolling average values, or combinations of both. The permit writer should understand, however, that the use of rolling averages requires that the facility be equipped with a digital process monitoring and recording system. Facilities that use only pneumatic or other analog-type instrumentation may not be capable of managing process monitoring data in a manner that permits rolling average computation.

Permit Limits: The following is a discussion of the three basic approaches to developing permit limits.

- Instantaneous. Recommended for control parameters that are not subject to fluctuations in excess of 10 percent of the mean value. Use of instantaneous limits for control parameters with greater variations will result in excessive AWFCO events. The pressure within the primary combustion chamber (PCC) of a typical rotary kiln incinerator system is an example of a control parameter suited to instantaneous limits.

- Rolling Average. Recommended for control parameters that experience variations in excess of 10 percent of the mean values. Examples include primary combustion zone temperature and CO concentrations in stack gases. The most common averaging period is 1 hour, although 24-hour and even yearly averages have been specified. Yearly averages are especially useful in limiting emissions of contaminants of concern to the indirect risk assessment (for example, carcinogenic metals and polychlorinated dibenzo(p)dioxins and polychlorinated dibenzofurans [PCDD/PCDF]). When yearly averages are used to control risks, the yearly average limits are imposed in addition to instantaneous or other rolling average limits.

- Combinations of Instantaneous and Rolling Average. Occasionally, the permit writer may elect to limit a control parameter on both an instantaneous and rolling average basis. The charge rate and batch size of solid waste fed to a rotary kiln is one parameter that is frequently limited in this manner.

Check For: The following subsections, Section 5.3.1 through 5.3.5, explain how to develop permit conditions for Group A, B, and C parameters using various types of limits:

- ❑ Establishing feed rate limits for metals
- ❑ Translating trial burn results into permit limits, Group A and B parameters
- ❑ Establishing operating limits for Group C parameters
- ❑ Translating risk assessment results into permit conditions
- ❑ Using risk burn data to set risk-based permit conditions

Examples: Attachment N contains process monitoring data collected during three runs of a recent trial burn. The recorded data are 60-second averages. Observe that the PCC temperature was relatively steady throughout all three runs. Given that observation, it would be appropriate to use these 60-second averages to formulate permit limits for the primary combustion chamber temperature as follows:

Minimum PCC temperature = average of the lowest 60-second average temperature recorded in each of the three runs.

$$= \frac{2050.30 + 2045.5 + 2007}{3}$$

$$= 2034.26^\circ F$$

The minimum permitted PCC temperature would thus be 2035°F.

Maximum PCC temperature = average of the highest 60-second average temperature recorded in each of the three runs.

$$= \frac{2146.50 \text{ or } 2166.8 + 2126.3}{3}$$

$$= 2146.53^\circ F$$

The maximum permitted PCC temperature would thus be 2146°F.

Notes: ____

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5.3.1 Establishing Feed Rate Limits for Metals

Regulations: 40 CFR Parts 266.106

Guidance: U.S. EPA, 1992. "Technical Implementation Document (TID) for EPA's BIF Regulations." EPA-530-R-92-011, pp. 2-2 to 2-18 and 10-14 to 10-19.

Explanation: A hazardous waste combustion unit is subject to feed rate limits for both noncarcinogenic and carcinogenic metals. The first step in establishing feed rate limits for metals is to comply with the metals emissions standards of 40 CFR Part 266.106 using the Tier I, adjusted Tier I, Tier II, or Tier III approach. Tier I, adjusted Tier I, and Tier III are more commonly used. Tier II is seldom used and is not discussed further in this section.

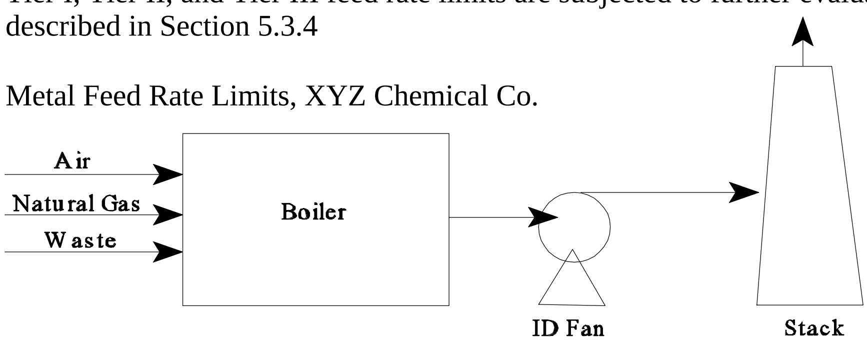
Under the Tier I approach, all metal fed to the unit is assumed to be emitted from the stack. No stack sampling for metals or dispersion modeling is required. Tier I is normally used when low levels of noncarcinogenic metals are present in the waste.

Adjusted Tier I assumes no metals removal by the system but requires site-specific dispersion modeling that accounts for plume dispersion. No stack sampling for metals is required. Adjusted Tier I is commonly used when relatively high levels of metals are present in the waste.

Under Tier III, stack sampling for metals and site-specific dispersion modeling are required. Predicted maximum ground level air concentrations of metals are compared to health-based standards to demonstrate that acceptable ambient levels are not exceeded. Tier III is used when high levels of carcinogenic metals are present in the waste and the facility is not eligible for Tier I (narrow valley, high terrain rise, or nearby large body of water, for example.). It should be noted that facilities will frequently pursue a Tier I or Adjusted Tier I approach for noncarcinogenic metals (antimony, barium, lead, mercury, nickel, selenium, silver, and thallium) and a Tier III approach for carcinogenic metals (arsenic, beryllium, cadmium, chromium).

The feed rate screening limits established using the approaches outlined above are based on health standards that account only for inhalation risks. As such, they may not be consistent with limits that account for multiple pathways of exposure. To establish limits based on multipathway risks, the Tier I, adjusted Tier I, Tier II, and Tier III feed rate limits are subjected to further evaluation as described in Section 5.3.4

Example: Metal Feed Rate Limits, XYZ Chemical Co.



Boiler Flow Diagram

Background: Noncarcinogenic metals in the waste feed are antimony, barium, lead, mercury, silver, and thallium. Carcinogenic metals in the waste feed are arsenic, cadmium, chromium, and beryllium.

Stack gas flow rate = 22,250 cfm ≈ 10.5 cubic meters per second (m^3/sec)
Stack height = 66 feet ≈ 20 meters
Stack gas temperature = 188°F ≈ 360 degrees Kelvin (°K)
Surrounding terrain is flat (noncomplex)
Surrounding land use is urban

Scenario 1: XYZ is pursuing Tier I for noncarcinogenic and carcinogenic metals.

TIER I FEED RATE SCREENING LIMITS FOR NONCARCINOGENIC METALS

Step 1 - Compute Effective Stack Height (ESH) and Terrain Adjusted Effective Stack Heigh (TAESH)

ESH = Ta +Ti
Where Ta = actual stack height, 20m
Ti = plume rise
Ti, plume rise is obtained from 40 CFR 266 Appendix VI (see Exhibit 5.3.1-6, page 7-46) (intersection of 10.5 m^3/sec and 360°K) 10m
ESH = 20m + 10m = 30m
TAESH = ESH - Tr
Where Tr = terrain rise within 5 km
Tr = terrain rise - 0 (flat, noncomplex)
TAESH Tr = 30 m - 0 = 30m

Step 2 - Determine Feed Rate Screening Limits

refer to 40 CFR 266 Appendix I, Table 1-A (see Exhibit 5.3.1-3, pages 7-43), feed rate screening limits (FRSL) are as follows:

Antimony	300 grams per hour (g/hr)
Barium	50,000 g/hr
Lead	90 g/hr
Mercury	300 g/hr
Silver	3,000 g/hr
Thallium	300 g/hr

TIER I FEED RATE SCREENING LIMITS FOR CARCINOGENIC METALS

TAESH remains 30m

from Table 1-D (see Exhibit 5.3.1-3, page 7-43) FRSL are as follows:

Arsenic	2.3 g/hr
Cadmium	5.4 g/hr
Chromium	0.82 g/hr
Beryllium	4.0 g/hr

but the sum of ratios of actual feed rates (AFR) to FRSL must be less than or equal to 1

$$\Sigma\,(AFR_i/FRSL_i) \leq 1$$

see table below:

Metal	AFR*	FRSL	AFR/FRSL
Arsenic	0.575	2.30	0.25
Cadmium	1.20	5.40	0.22
Chromium	0.18	0.82	0.22
Beryllium	0.90	4.00	0.23
Sum			**0.92**

*The facility provided the actual feed rates.

Scenario 2: XYZ Chemical Co. pursues Tier III limits for all metals.

Step 1 - Conduct trial burn, measure metals in waste feed and stack emissions.

Step 2 - Conduct dispersion modeling, determine dispersion coefficient, and calculate ambient concentrations of metals at the maximum exposed individual (MEI) (see Exhibit 5.3.1-1, page 7-41).

<u>Noncarcinogenic Metals</u>

Step 3 - Compare the predicted ambient concentrations of noncarcinogenic metals to the reference air concentrations (RACs) in 40 CFR 266 Appendix IV (see Exhibit 5.3.1-4, page 7-44).

Step 4 - If ambient concentrations are less than RACs, feed rate limits for noncarcinogenic metals are the metals feed rates measured during the trial burn (see table below).

Metal	Feed Rate During Trial Burn (g/hr)	Ambient Air Concentration Predicted by Model micrograms per cubic meter ($\mu g/m^3$)	RAC $\mu g/m^3$)	Tier III Feed Rate Limit (g/hr)
Antimony	500	0.050	0.30	500
Barium	1,000	1.200	50.00	1,000
Lead	300	0.010	0.09	300
Mercury	400	0.005	0.30	400
Silver	50	0.200	3.00	50
Thallium	75	0.001	0.50	75

Carcinogenic Metals

Step 3 - compare the predicted ambient concentrations of carcinogenic metals to the risk specific doses (RSDs) in 40 CFR 266 Appendix V (see Exhibit 5.3.1-5, page 7-45).

Step 4 - feed rate limits for carcinogenic metals are the metals feed rates demonstrated during the trial burn provided the sum of the ratios of ambient concentrations to RSDs does not exceed 1 (see table below).

Metal	Feed Rate During Trial Burn (g/hr)	Ambient Air Concentration Predicted By Model ($\mu g/m^3$)	RSD ($\mu g/m^3$)	Ambient/ RSD	Tier III Feed Rate Limit (g/hr)
Arsenic	5	0.0005	0.0023	0.217	5
Beryllium	1	0.0012	0.0042	0.286	1
Cadmium	3	0.001	0.0056	0.179	3
Chromium	4	0.0001	0.00083	0.120	4
Sum				**0.802**	

EPA guidance suggests that feed rate limits may be extrapolated or interpolated from emissions measurements during the trial burn. If a facility, for example, did not spike metals during the trial burn and measured emissions were several orders of magnitude below the maximum levels allowed under Tier III (very low ratios of predicted ambient air concentrations to RACs or RSDs), extrapolation upward may be allowable. However, if a facility spikes metals during the trial burn and the metals emissions are above Tier III limits, extrapolation downward of metals feed limits is discouraged. The reader is referred to the BIF TID guidance (pp. 10-14 through 10-19) for more information on extrapolation and interpolation of trial burn emissions measurements.

Notes:

EXHIBIT 5.3.1-1
MAXIMUM EXPOSED INDIVIDUAL

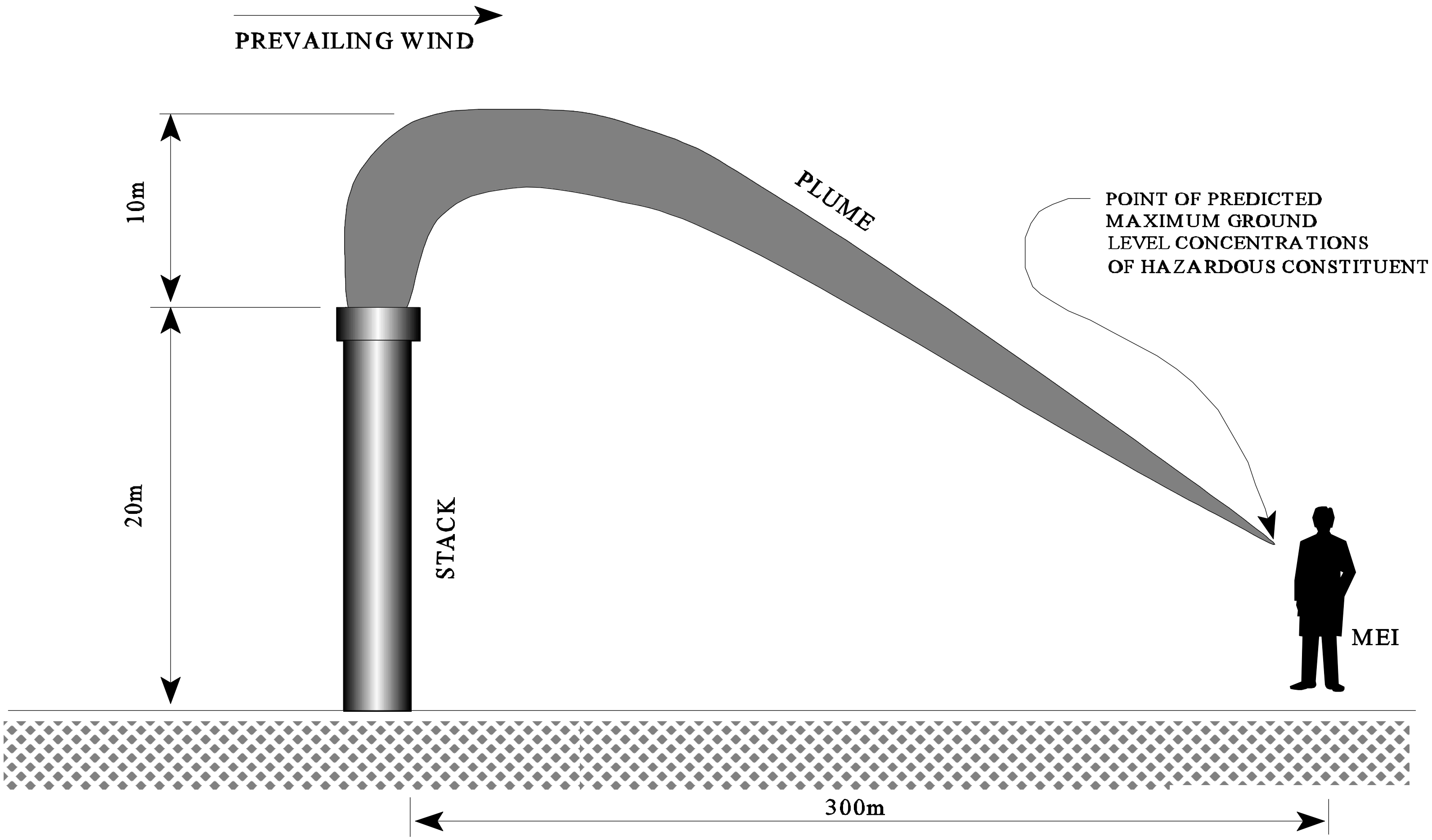


EXHIBIT 5.3.1-2
APPENDIX I, TABLE 1-A

APPENDIX I TO PART 266—TIER I AND TIER II FEED RATE AND EMISSIONS SCREENING LIMITS FOR METALS

TABLE I-A—TIER I AND TIER II FEED RATE AND EMISSIONS SCREENING LIMITS FOR NONCARCINOGENIC METALS FOR FACILITIES IN NONCOMPLEX TERRAIN

[Values for urban areas]

Terrain adjusted eff. stack ht. (m)	Antimony (g/hr)	Barium (g/hr)	Lead (g/hr)	Mercury (g/hr)	Silver (g/hr)	Thallium (g/hr)
4	6.0E+01	1.0E+04	1.8E+01	6.0E+01	6.0E+02	6.0E+01
6	6.8E+01	1.1E+04	2.0E+01	6.8E+01	6.8E+02	6.8E+01
8	7.6E+01	1.3E+04	2.3E+01	7.6E+01	7.6E+02	7.6E+01
10	8.6E+01	1.4E+04	2.6E+01	8.6E+01	8.6E+02	8.6E+01
12	9.6E+01	1.7E+04	3.0E+01	9.6E+01	9.6E+02	9.6E+01
14	1.1E+02	1.8E+04	3.4E+01	1.1E+02	1.1E+03	1.1E+02
16	1.3E+02	2.1E+04	3.6E+01	1.3E+02	1.3E+03	1.3E+02
18	1.4E+02	2.4E+04	4.3E+01	1.4E+02	1.4E+03	1.4E+02
20	1.6E+02	2.7E+04	4.6E+01	1.6E+02	1.6E+03	1.6E+02
22	1.8E+02	3.0E+04	5.4E+01	1.8E+02	1.8E+03	1.8E+02
24	2.0E+02	3.4E+04	6.0E+01	2.0E+02	2.0E+03	2.0E+02
26	2.3E+02	3.9E+04	6.8E+01	2.3E+02	2.3E+03	2.3E+02
28	2.6E+02	4.3E+04	7.8E+01	2.6E+02	2.6E+03	2.6E+02
30	3.0E+02	5.0E+04	9.0E+01	3.0E+02	3.0E+03	3.0E+02
35	4.0E+02	6.6E+04	1.1E+02	4.0E+02	4.0E+03	4.0E+02
40	4.6E+02	7.8E+04	1.4E+02	4.6E+02	4.6E+03	4.6E+02
45	6.0E+02	1.0E+05	1.8E+02	6.0E+02	6.0E+03	6.0E+02
50	7.8E+02	1.3E+05	2.3E+02	7.8E+02	7.8E+03	7.8E+02
55	9.6E+02	1.7E+05	3.0E+02	9.6E+02	9.6E+03	9.6E+02
60	1.2E+03	2.0E+05	3.6E+02	1.2E+03	1.2E+04	1.2E+03
65	1.5E+03	2.5E+05	4.3E+02	1.5E+03	1.5E+04	1.5E+03
70	1.7E+03	2.8E+05	5.0E+02	1.7E+03	1.7E+04	1.7E+03
75	1.9E+03	3.2E+05	5.8E+02	1.9E+03	1.9E+04	1.9E+03
80	2.2E+03	3.6E+05	6.4E+02	2.2E+03	2.2E+04	2.2E+03
85	2.5E+03	4.0E+05	7.6E+02	2.5E+03	2.5E+04	2.5E+03
90	2.8E+03	4.6E+05	8.2E+02	2.8E+03	2.8E+04	2.8E+03
95	3.2E+03	5.4E+05	9.6E+02	3.2E+03	3.2E+04	3.2E+03
100	3.6E+03	6.0E+05	1.1E+03	3.6E+03	3.6E+04	3.6E+03
105	4.0E+03	6.8E+05	1.2E+03	4.0E+03	4.0E+04	4.0E+03
110	4.6E+03	7.8E+05	1.4E+03	4.6E+03	4.6E+04	4.6E+03
115	5.4E+03	8.6E+05	1.6E+03	5.4E+03	5.4E+04	5.4E+03
120	6.0E+03	1.0E+06	1.8E+03	6.0E+03	6.0E+04	6.0E+03

EXHIBIT 5.3.1-3
APPENDIX I, TABLE 1-D

TABLE I–D—TIER I AND TIER II FEED RATE AND EMISSIONS SCREENING LIMITS FOR CARCINOGENIC METALS FOR FACILITIES IN NONCOMPLEX TERRAIN

	Values for use in urban areas				Values for use in rural areas			
Terrain adjusted eff. stack ht. (m)	Arsenic (g/hr)	Cadmium (g/hr)	Chromium (g/hr)	Beryllium (g/hr)	Arsenic (g/hr)	Cadmium (g/hr)	Chromium (g/hr)	Beryllium (g/hr)
4	4.6E-01	1.1E+00	1.7E-01	8.2E-01	2.4E-01	5.8E-01	8.6E-02	4.3E-01
6	5.4E-01	1.3E+00	1.9E-01	9.4E-01	2.8E-01	6.6E-01	1.0E-01	5.0E-01
8	6.0E-01	1.4E+00	2.2E-01	1.1E+00	3.2E-01	7.6E-01	1.1E-01	5.6E-01
10	6.8E-01	1.6E+00	2.4E-01	1.2E+00	3.6E-01	8.6E-01	1.3E-01	6.4E-01
12	7.6E-01	1.8E+00	2.7E-01	1.4E+00	4.3E-01	1.1E+00	1.6E-01	7.8E-01
14	8.6E-01	2.1E+00	3.1E-01	1.5E+00	5.4E-01	1.3E+00	2.0E-01	9.6E-01
16	9.6E-01	2.3E+00	3.5E-01	1.7E+00	6.8E-01	1.6E+00	2.4E-01	1.2E+00
18	1.1E+00	2.6E+00	4.0E-01	2.0E+00	8.2E-01	2.0E+00	3.0E-01	1.5E+00
20	1.2E+00	3.0E+00	4.4E-01	2.2E+00	1.0E+00	2.5E+00	3.7E-01	1.9E+00
22	1.4E+00	3.4E+00	5.0E-01	2.5E+00	1.3E+00	3.2E+00	4.8E-01	2.4E+00
24	1.6E+00	3.9E+00	5.8E-01	2.8E+00	1.7E+00	4.0E+00	6.0E-01	3.0E+00
26	1.8E+00	4.3E+00	6.4E-01	3.2E+00	2.1E+00	5.0E+00	7.6E-01	3.9E+00
28	2.0E+00	4.8E+00	7.2E-01	3.6E+00	2.7E+00	6.4E+00	9.8E-01	5.0E+00
30	2.3E+00	5.4E+00	8.2E-01	4.0E+00	3.5E+00	8.2E+00	1.2E+00	6.2E+00
35	3.0E+00	6.8E+00	1.0E+00	5.4E+00	5.4E+00	1.3E+01	1.9E+00	9.6E+00
40	3.6E+00	9.0E+00	1.3E+00	6.8E+00	8.2E+00	2.0E+01	3.0E+00	1.5E+01
45	4.6E+00	1.1E+01	1.7E+00	8.6E+00	1.1E+01	2.8E+01	4.2E+00	2.1E+01
50	6.0E+00	1.4E+01	2.2E+00	1.1E+01	1.5E+01	3.7E+01	5.4E+00	2.8E+01
55	7.6E+00	1.8E+01	2.7E+00	1.4E+01	2.0E+01	5.0E+01	7.2E+00	3.6E+01
60	9.4E+00	2.2E+01	3.4E+00	1.7E+01	2.7E+01	6.4E+01	9.6E+00	4.8E+01
65	1.1E+01	2.8E+01	4.2E+00	2.1E+01	3.6E+01	8.6E+01	1.3E+01	6.4E+01
70	1.3E+01	3.1E+01	4.6E+00	2.4E+01	4.3E+01	1.0E+02	1.5E+01	7.6E+01
75	1.5E+01	3.6E+01	5.4E+00	2.7E+01	5.0E+01	1.2E+02	1.8E+01	9.0E+01
80	1.7E+01	4.0E+01	6.0E+00	3.0E+01	6.0E+01	1.4E+02	2.2E+01	1.1E+02
85	1.9E+01	4.6E+01	6.8E+00	3.4E+01	7.2E+01	1.7E+02	2.6E+01	1.3E+02
90	2.2E+01	5.0E+01	7.8E+00	3.9E+01	8.6E+01	2.0E+02	3.0E+01	1.5E+02
95	2.5E+01	5.8E+01	9.0E+00	4.4E+01	1.0E+02	2.4E+02	3.6E+01	1.8E+02
100	2.8E+01	6.8E+01	1.0E+01	5.0E+01	1.2E+02	2.9E+02	4.3E+01	2.2E+02
105	3.2E+01	7.6E+01	1.1E+01	5.6E+01	1.4E+02	3.4E+02	5.0E+01	2.6E+02
110	3.6E+01	8.6E+01	1.3E+01	6.4E+01	1.7E+02	4.0E+02	6.0E+01	3.0E+02
115	4.0E+01	9.6E+01	1.5E+01	7.2E+01	2.0E+02	4.8E+02	7.2E+01	3.6E+02
120	4.6E+01	1.1E+02	1.7E+01	8.2E+01	2.4E+02	5.8E+02	8.6E+01	4.3E+02

EXHIBIT 5.3.1-4
APPENDIX IV

[56 FR 32691, July 17, 1991]

APPENDIX IV TO PART 266—REFERENCE AIR CONCENTRATIONS*

Constituent	CAS No.	RAC (ug/ m³)
Acetaldehyde	75–07–0	10
Acetonitrile	75–05–8	10
Acetophenone	98–86–2	100
Acrolein	107–02–8	20
Aldicarb	116–06–3	1
Aluminum Phosphide	20859–73–8	0.3
Allyl Alcohol	107–18–6	5
Antimony	7440–36–0	0.3
Barium	7440–39–3	50
Barium Cyanide	542–62–1	50
Bromomethane	74–83–9	0.8
Calcium Cyanide	592–01–8	30
Carbon Disulfide	75–15–0	200
Chloral	75–87–6	2
Chlorine (free)	....	0.4
2-Chloro-1,3-butadiene	126–99–8	3
Chromium III	16065–83–1	1000
Copper Cyanide	544–92–3	5
Cresols	1319–77–3	50
Cumene	98–82–8	1
Cyanide (free)	57–12–15	20
Cyanogen	460–19–5	30
Cyanogen Bromide	506–68–3	80
Di-n-butyl Phthalate	84–74–2	100
o-Dichlorobenzene	95–50–1	10
p-Dichlorobenzene	106–46–7	10
Dichlorodifluoromethane	75–71–8	200
2,4-Dichlorophenol	120–83–2	3
Diethyl Phthalate	84–66–2	800
Dimethoate	60–51–5	0.8
2,4-Dinitrophenol	51–28–5	2
Dinoseb	88–85–7	0.9
Diphenylamine	122–39–4	20
Endosulfan	115–29–1	0.05
Endrin	72–20–8	0.3
Fluorine	7782–41–4	50
Formic Acid	64–18–6	2000
Glycidyaldehyde	765–34–4	0.3
Hexachlorocyclopentadiene	77–47–4	5
Hexachlorophene	70–30–4	0.3
Hydrocyanic Acid	74–90–8	20
Hydrogen Chloride	7647–01–1	7
Hydrogen Sulfide	7783–06–4	3
Isobutyl Alcohol	78–83–1	300

APPENDIX IV TO PART 266—REFERENCE AIR CONCENTRATIONS*—Continued

Constituent	CAS No.	RAC (ug/ m³)
Lead	7439–92–1	0.09
Maleic Anyhdride	108–31–6	100
Mercury	7439–97–6	0.3
Methacrylonitrile	126–98–7	0.1
Methomyl	16752–77–5	20
Methoxychlor	72–43–5	50
Methyl Chlorocarbonate	79–22–1	1000
Methyl Ethyl Ketone	78–93–3	80
Methyl Parathion	298–00–0	0.3
Nickel Cyanide	557–19–7	20
Nitric Oxide	10102–43–9	100
Nitrobenzene	98–95–3	0.8
Pentachlorobenzene	608–93–5	0.8
Pentachlorophenol	87–86–5	30
Phenol	108–95–2	30
M-Phenylenediamine	108–45–2	5
Phenylmercuric Acetate	62–38–4	0.075
Phosphine	7803–51–2	0.3
Phthalic Anhydride	85–44–9	2000
Potassium Cyanide	151–50–8	50
Potassium Silver Cyanide	506–61–6	200
Pyridine	110–86–1	1
Selenious Acid	7783–60–8	3
Selenourea	630–10–4	5
Silver	7440–22–4	3
Silver Cyanide	506–64–9	100
Sodium Cyanide	143–33–9	30
Strychnine	57–24–9	0.3
1,2,4,5-Tetrachlorobenzene	95–94–3	0.3
2,3,4,6-Tetrachlorophenol	58–90–2	30
Tetraethyl Lead	78–00–2	0.0001
Tetrahydrofuran	109–99–9	10
Thallic Oxide	1314–32–5	0.3
Thallium	7440–28–0	0.5
Thallium (I) Acetate	563–68–8	0.5
Thallium (I) Carbonate	6533–73–9	0.3
Thallium (I) Chloride	7791–12–0	0.3
Thallium (I) Nitrate	10102–45–1	0.5
Thallium Selenite	12039–52–0	0.5
Thallium (I) Sulfate	7446–18–6	0.075
Thiram	137–26–8	5
Toluene	108–88–3	300
1,2,4-Trichlorobenzene	120–82–1	20
Trichloromonofluoromethane	75–69–4	300
2.4.5-Trichlorophenol	95–95–4	100
Vanadium Pentoxide	1314–62–1	20

EXHIBIT 5.3.1-5
APPENDIX V

APPENDIX V TO PART 266—RISK SPECIFIC DOSES (10^{-5})

Constituent	CAS No.	Unit risk (m3/ug)	RsD (ug/m3)
Acrylamide	79–06–1	1.3E-03	7.7E-03
Acrylonitrile	107–13–1	6.8E-05	1.5E-01
Aldrin	309–00–2	4.9E-03	2.0E-03
Aniline	62–53–3	7.4E-06	1.4E+00
Arsenic	7440–38–2	4.3E-03	2.3E-03
Benz(a)anthracene	56–55–3	8.9E-04	1.1E-02
Benxene	71–43–2	8.3E-06	1.2E+00
Benzidine	92–87–5	6.7E-02	1.5E-04
Benzo(a)pyrene	50–32–8	3.3E-03	3.0E-03
Beryllium	7440–41–7	2.4E-03	4.2E-03
Bis(2-chloroethyl)ether	111–44–4	3.3E-04	3.0E-02
Bis(chloromethyl)ether	542–88–1	6.2E-02	1.6E-04
Bis(2-ethylhexyl)-phthalate	117–81–7	2.4E-07	4.2E+01
1,3-Butadiene	106–99–0	2.8E-04	3.6E-02
Cadmium	7440–43–9	1.8E-03	5.6E-03
Carbon Tetrachloride	56–23–5	1.5E-05	6.7E-01
Chlordane	57–74–9	3.7E-04	2.7E-02
Chloroform	67–66–3	2.3E-05	4.3E-01
Chloromethane	74–87–3	3.6E-06	2.8E+00
Chromium VI	7440–47–3	1.2E-02	8.3E-04
DDT	50–29–3	9.7E-05	1.0E-01
Dibenz(a,h)anthracene	53–70–3	1.4E-02	7.1E-04
1,2-Dibromo-3-chloropropane	96–12–8	6.3E-03	1.6E-03
1,2-Dibromoethane	106–93–4	2.2E-04	4.5E-02
1,1-Dichloroethane	75–34–3	2.6E-05	3.8E-01
1,2-Dichloroethane	107–06–2	2.6E-05	3.8E-01
1,1-Dichloroethylene	75–35–4	5.0E-05	2.0E-01
1,3-Dichloropropene	542–75–6	3.5E-01	2.9E-05
Dieldrin	60–57–1	4.6E-03	2.2E-03
Diethylstilbestrol	56–53–1	1.4E-01	7.1E-05
Dimethylnitrosamine	62–75–9	1.4E-02	7.1E-04
2,4-Dinitrotoluene	121–14–2	8.8E-05	1.1E-01
1,2-Diphenylhydrazine	122–66–7	2.2E-04	4.5E-02
1,4-Dioxane	123–91–1	1.4E-06	7.1E+00
Epichlorohydrin	106–89–8	1.2E-06	8.3E+00
Ethylene Oxide	75–21–8	1.0E-04	1.0E-01
Ethylene Dibromide	106–93–4	2.2E-04	4.5E-02
Formaldehyde	50–00–0	1.3E-05	7.7E-01
Heptachlor	76–44–8	1.3E-03	7.7E-03
Heptachlor Epoxide	1024–57–3	2.6E-03	3.8E-03
Hexachlorobenzene	118–74–1	4.9E-04	2.0E-02
Hexachlorobutadiene	87–68–3	2.0E-05	5.0E-01
Alpha-hexachloro-cyclohexane	319–84–6	1.8E-03	5.6E-03
Beta-hexachloro-cyclohexane	319–85–7	5.3E-04	1.9E-02
Gamma-hexachloro-cyclohexane	58–89–9	3.8E-04	2.6E-02
Hexachlorocyclo-hexane, Technical	....	5.1E-04	2.0E-02
Hexachlorodibenxo-p-dioxin(1,2 Mixture)	....	1.3E+0	7.7E-06
Hexachloroethane	67–72–1	4.0E-06	2.5E+00
Hydrazine	302–01–2	2.9E-03	3.4E-03
Hydrazine Sulfate	302–01–2	2.9E-03	3.4E-03
3-Methylcholanthrene	56–49–5	2.7E-03	3.7E-03
Methyl Hydrazine	60–34–4	3.1E-04	3.2E-02
Methylene Chloride	75–09–2	4.1E-06	2.4E+00
4,4'-Methylene-bis-2-chloroaniline	101–14–4	4.7E-05	2.1E-01
Nickel	7440–02–0	2.4E-04	4.2E-02
Nickel Refinery Dust	7440–02–0	2.4E-04	4.2E-02
Nickel Subsulfide	12035–72–2	4.8E-04	2.1E-02
2-Nitropropane	79–46–9	2.7E-02	3.7E-04
2,3,7,8-Tetrachloro-dibenzo-p-dioxin	1746–01–6	4.5E+01	2.2E-07
1,1,2,2-Tetrachloroethane	79–34–5	5.8E-05	1.7E-01
Tetrachloroethylene	127–18–4	4.8E-07	2.1E+01
Thiourea	62–56–6	5.5E-04	1.8E-02
1,1,2-Trichloroethane	79–00–5	1.6E-05	6.3E-01
Trichloroethylene	79–01–6	1.3E-06	7.7E+00
2,4,6-Trichlorophenol	88–06–2	5.7E-06	1.8E+00
Toxaphene	8001–35–2	3.2E-04	3.1E-02
Vinyl Chloride	75–01–4	7.1E-06	1.4E+00

EXHIBIT 5.3.1-6
APPENDIX VI

APPENDIX VI TO PART 266—STACK PLUME RISE

[Estimated Plume Rise (in Meters) Based on Stack Exit Flow Rate and Gas Temperature]

Flow rate (m3/s)	Exhaust Temperature (K°)										
	<325	325–349	350–399	400–449	450–499	500–599	600–699	700–799	800–999	1000–1499	>1499
<0.5	0	0	0	0	0	0	0	0	0	0	0
0.5–0.9	0	0	0	0	0	0	0	0	1	1	1
1.0–1.9	0	0	0	0	1	1	2	3	3	3	4
2.0–2.9	0	0	1	3	4	4	6	6	7	8	9
3.0–3.9	0	1	2	5	6	7	9	10	11	12	13
4.0–4.9	1	2	4	6	8	10	12	13	14	15	17
5.0–7.4	2	3	5	8	10	12	14	16	17	19	21
7.5–9.9	3	5	8	12	15	17	20	22	22	23	24
10.0–12.4	4	6	10	15	19	21	23	24	25	26	27
12.5–14.9	4	7	12	18	22	23	25	26	27	28	29
15.0–19.9	5	8	13	20	23	24	26	27	28	29	31
20.0–24.9	6	10	17	23	25	27	29	30	31	32	34
25.0–29.9	7	12	20	25	27	29	31	32	33	35	36
30.0–34.9	8	14	22	26	29	31	33	35	36	37	39
35.0–39.9	9	16	23	28	30	32	35	36	37	39	41
40.0–49.9	10	17	24	29	32	34	36	38	39	41	42
50.0–59.9	12	21	26	31	34	36	39	41	42	44	46
60.0–69.9	14	22	27	33	36	39	42	43	45	47	49
70.0–79.9	16	23	29	35	38	41	44	46	47	49	51
80.0–89.9	17	25	30	36	40	42	46	48	49	51	54
90.0–99.9	19	26	31	38	42	44	48	50	51	53	56
100.0–119.9	21	26	32	39	43	46	49	52	53	55	58
120.0–139.9	22	28	35	42	46	49	52	55	56	59	61
140.0–159.9	23	30	36	44	48	51	55	58	59	62	65
160.0–179.9	25	31	38	46	50	54	58	60	62	65	67
180.0–199.9	26	32	40	48	52	56	60	63	65	67	70
>199.9	26	33	41	49	54	58	62	65	67	69	73

5.3.2 Translating Trial Burn Results Into Permit Limits, Group A and B Parameters

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Parts 270.32, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: Group A parameters are operating conditions of the combustion and APCS that are critical to achieving of destruction and removal efficiency (DRE) and emissions limits for CO, PICs, and metals emissions limits. These parameters are continuously monitored and interlocked with the AWFCO system.

Group B parameters are operating conditions that are neither continuously monitored nor interlocked with the AWFCO system.

Permit Limits: Lists of Group A and B parameters provided below are typical but not all-inclusive. Group A and B parameters may vary from facility to facility.

<u>Group A Parameters - May Be Established as Rolling Average or Instantaneous Limits or Both</u>

- <u>Minimum PCC temperature</u>. Ensures achievement of required DRE
- <u>Maximum PCC temperature</u>. Prevents excessive volatilization of metals
- <u>Minimum SCC temperature</u>. Ensures DRE achievement
- <u>Maximum stack gas CO concentration</u>. Ensures compliance with the applicable regulatory standard
- <u>Maximum combustion gas volumetric flow rate</u>. Ensures achievement of DRE
- <u>Maximum hazardous waste feed rate</u>. Ensures DRE achievement and emissions limits compliance for particulate matter (PM), hydrogen chloride (HCl), metals, and PICs
- <u>Total pumpable hazardous waste rate</u>. Ensures DRE achievement and emissions limits compliance for particulate matter, HCl, metals, and PICs
- <u>Maximum solid waste batch and container size</u>. Ensures proper combustion conditions
- <u>Maximum stack gas THC</u>. Ensures compliance with the applicable regulatory standard

- Minimum and maximum device production rate. Ensures proper combustion conditions
- Maximum flue gas temperature entering a particulate matter control device. Minimizes dioxin/furan formation within the device and ensures proper particulate removal

- Minimum wet scrubber blowdown rate. Ensures proper performance of wet scrubber and compliance with limits on PM and acid gas emissions

Group B Parameters - May Be Established as Rolling Average or Instantaneous Limits or Both

- Principal organic hazardous constituent (POHC) Incinerability. Restricts waste feeds to materials that were represented during the trial burn and as a result, ensures DRE achievement and emissions limits compliance for PM, HCl, metals, and PICs

- Maximum chloride content of waste feed. Ensures compliance with emissions limits on HCl

- Maximum ash content of waste feed. Ensure compliance with limits on PM and metals emissions (except kilns)

Examples: Group A, Limits on Stack Gas Flowrate

The stack gas flowrate is a Group A parameter for which permit limits are developed based on trial burn results. Upon examining the stack gas flowrate data in Attachment N, it is apparent this parameter is subject to wide fluctuations. In the second run, for example, the stack gas flow rate varied from 3,942 to 7,104 actual cubic feet per minute (acfm). This situation calls for a combination limit, developed as follows:

Mean of 60-second averages in run 1 = 4,941.20 acfm
Mean of 60-second averages in run 2 = 4,926.10 acfm
Mean of 60-second averages in run 3 = 4,927.36 acfm

Average = (4,941.20 + 4,926.10 + 4,927.36)/3 = 4,931.55 acfm

Highest 60-second flowrate in run 1 = 7,138.58 acfm
Highest 60-second flowrate in run 2 = 7,104.29 acfm
Highest 60-second flowrate in run 3 = 6,729.11 acfm

Average = (7,138.58 + 7,104.29 + 6,729.11)/3 = 6,990.66 acfm

The permit conditions would read as follows:

The hourly rolling average (HRA) of the stack gas flow shall not exceed 4,932 acfm. The instantaneous stack gas flow shall not exceed 6,991 acfm at any time.

Notes: ____________________

5.3.3 Establishing Operating Limits for Group C Parameters

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Parts 270.32, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: To ensure that combustion system operations adhere to process design specifications, operating limits for Group C parameters are based strictly on design and equipment manufacturers' recommendations and not on trial burn results.

Permit Limits: Examples of Group C parameters include:

- Burner settings. Atomization fluid pressure, waste viscosity, and turndown limits. The limits on these parameters are bounded by manufacturers' specifications that are intended to ensure proper waste fuel atomization and combustion.

- Total heat input. Maximum heat input to PCC and maximum heat input to SCC. These limits are based on manufacturers' recommendations that are intended to prevent damage to refractory materials lining the combustion chambers.

- APCS equipment inlet gas temperature. Maximum temperature (for facilities with wet APCS) of combustion gases entering the APCS. These limits are based on manufacturers' recommendations which, in turn, are usually based on the physical properties of the APCS construction materials. NOTE: This will be an AWFCO for any facility with a dry APCS.

Examples: Clark included Group C parameters in the BIF permit issued by SCDHEC for the CIF are as follows. These parameters are also used to prevent dioxin formation in the post-combustion chamber.

- Maximum thermal release from PCC. 22.43 million British thermal units per hour (Btu)

- Maximum thermal release from SCC. 16.83 million Btu/hr

- Steam atomization pressure to high heating value (HHV) liquid burner. minimum of 80 psig

- Steam atomization pressure to low heating value (LHV) liquid burner. Minimum of 80 psig

- Maximum HHV burner turndown ratio. 4 to 1

- Maximum LHV burner turndown ratio. 10 to 1
- Quench liquid flow rate. At least 150 gallons per minute (gpm)
- Maximum quench outlet temperature. 210°F

Notes: ______________________________

5.3.4 Translating Risk Assessment Results Into Permit Conditions

Regulations: 40 CFR Parts 266.106, 270.32, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: Results of direct and indirect human health and ecological risk assessments can affect the final permit. The permit writer has five options for translating risk assessment results into permit conditions. These are: (1) reduce emissions with process changes or emissions controls; (2) verification by sampling and monitoring; (3) eliminating the risk pathway; (4) verifying assumptions in the risk assessment; and (5) denying the permit if the facility fails the risk assessment and the permit writer opts against using one or more of the four aforementioned options.

Examples: The permit issued to a commercial hazardous waste incinerator facility contains examples of the relationship between risk assessment and permit conditions and the use of the first two options introduced above.

<u>Commercial Hazardous Waste Incinerator</u>

During data review for permit condition preparation, Lois noted that stack testing during the trial burn in March 1993 indicated that dioxin levels were higher than expected, although still below risk-based standards. To address this concern, Lois used the following options:

Option 1—Reduce Emissions/Process Changes. Required the facility to install an activated carbon injection system for PCDD/PCDF control and implement a continuing program of performance testing for PCDD/PCDFs.

Option 2—Sampling and Monitoring. Under the performance testing program, the facility conducted quarterly stack sampling for dioxins for 2 years and annual sampling thereafter.

On reviewing the trial burn results for metals emissions, Lois became concerned that the emissions of four metals (barium, mercury, silver, and thallium) may pose an unacceptable risk to human health and the environment. Her approach to evaluating this risk and developing protective permit limits was as follows:

Option 1—Reduce Emissions/Limit Feed. Lois used the results of multipathway risk assessment to develop emission limits for metals in four steps (as summarized in Exhibit 5.3.4-1, see page 7-54): Step 1, hourly feed rate limits were calculated based on the direct exposure assessment methods prescribed under 40 CFR Part 266.106 (see Section 5.3.1 of this component); Step 2, dispersion, deposition, and bio-uptake modeling were used to determine cancer risks and hazard indices (HI) based on "maximum permit limit emission" scenarios presented by the limits derived in Step 1; Step 3 recommended emissions reduction factors were calculated by reducing the values of the ecological HI, human health HI, and cancer risks linearly to 1.0, 0.25, and Be-5, respectively; and Step 4, annual limits on metals emissions were calculated using reduction factors calculated in Step 2.

Ash Grove Cement, Chanute, Kansas

Clark noted that the indirect risk assessment conducted by a U.S. EPA contractor indicated a hazard quotient (HQ) from mercury to the recreational fisherman of 1.52. This HQ was an order of magnitude greater than the target of <0.25. Aquatic sampling results, however, indicated that actual mercury concentrations in sediments, water, and fish were not elevated.

Citing the discrepancy between risk assessment modeling and environmental sampling results, Clark determined that additional controls on mercury emissions from the cement kilns were not warranted but that he could use Option 2—Sampling and Monitoring, to require continuing environmental sampling for mercury. Consequently, Clark compelled AGC to conduct continuing environmental sampling for mercury under conditions specified in Section A.15 of the final permit (see Attachment O).

Notes: ____
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EXHIBIT 5.3.4-1

CALCULATION OF METALS EMISSIONS REDUCTION FACTORS

Metal	40 CFR 266.106 Feed Rate Limit (lb/hr) (1)	Possible Maximum Emissions pounds per year (lb/yr) (2)	Ecological Risk Assessment Hazard Index (3)	Human Health Risk Assessment Hazard Index (4)	Human Health Risk Assessment Cancer Risk (5)	Reduction Factor (6)	Revised Emission Limit (lb/yr) (7)	Penetration Factor (8)	Revised Risk-Based Annual Feed Rate Limit (lb/yr) (9)
Barium	473	3,820,000	41	1,400	NA	5,600	682	0.0023	296,584
Mercury	0.146	6,110	4.1	4.3	NA	17.2	355	1	355
Silver	15.9	229,000	5.2	60	NA	240	954	0.0023	414,855
Thallium	2.65	38,200	4.250	650	NA	4,250	9	0.0023	3,908

Notes:

1. Feed rate based on direct risk assessment procedures specified in 40 CFR 266.106 and developed in accordance with procedures shown in Section 5.3.1 of this component.
2. Possible maximum emissions based on dispersion modeling using feed rate limits discussed above.
3. Indirect risk assessment ecological hazard index. Target <1.
4. Indirect risk assessment human health hazard index. Target <0.25. Target reduced below 1 to ascribe only 25 percent of the human health risk to this single emissions source, per U.S. EPA 1998 Region 6 risk protocols.
5. Indirect risk assessment human health cancer risk. Target <1 E-5.
6. Reduction factor applied to possible maximum emissions that will reduce ecological and human health risks and cancer risks below target levels defined above.
7. Possible maximum emissions divided by reduction factor
8. Empirically or theoretically determined metals penetration factor (1 - removal efficiency).
9. Revised emission limit divided by penetration factor.

5.3.5 Using Risk Burn Data to Set Risk-Based Permit Conditions for Operating Parameters

Regulations: 40 CFR Parts 270.30

Guidance: No specific references are applicable to this section of the manual.

Explanation: Hazardous waste combustion facilities are required to conduct testing for dioxins, furan, other organic PICs, and metals to provide input data for multipathway risk assessments. These data are collected during three runs of a risk burn that may be conducted under either "worst case" operating conditions equivalent to those of the traditional DRE burn, or "normal" operating conditions that reflect typical plant operations.

If the facility elects to conduct the risk burn under normal conditions, the permit for the facility must contain additional conditions to ensure that long-term operations are consistent with those represented as normal during the risk burn.

Risk, as defined by the multipathway risk assessment, is a function of the emission rates of metals and organic constituents from the stack. To determine the operating parameters that must be subjected to additional risk-based controls, the permit writer should first, review process information contained in the trial burn report or permit application, and second, construct Pareto ("fish-bone") diagrams similar to those shown on Exhibits 5.3.5-1 (see page 7-57) and 5.3.5-2 (see page 7-58) to illustrate correlations and causal relationships between processing operating parameters and emissions of metals and organic PICs. In these diagrams, the length of the line is proportional to the known or perceived strength of the correlation. For example, in Exhibit 5.3.5-2 (see page 7-58), the emission rate of metals is shown to be strongly correlated to combustion temperature. The third step is to set risk-based permit conditions for the strongly correlated parameters based on the risk burn data.

The additional risk-based limits may encompass the following parameters:

- Waste feed rates
- Combustion chamber temperature
- Stack gas velocity

These limits and related permitting approaches are further discussed in Attachment U, Traditional vs. Risk-Based Permitting Approach: Permit to Manage Risks, by David Weeks.

One of the areas of focus in the Environmental Appeals Board ruling on the Ash Grove Cement, Chanute, Kansas, permit supports establishing risk-based operating limits in the permit. The ruling is included as Attachment V to this component.

Examples:

The risk burn for a boiler was conducted under normal operating conditions. The combustion temperature, waste feed rate, and stack gas flow rate during the risk burn were significantly different than those measured during the DRE burn, as shown in Exhibit 5.3.5-3 (see page 7-59). Referring to the Pareto diagrams in Exhibits 5.3.5-1 (see page 7-57) and 5.3.5-2 (see page 7-58), Clark decided that risk-based annual rolling average limits would be imposed on the waste feed rate, combustion temperature, and stack gas velocity. Annual rolling averages are defined as the arithmetic mean of all 60-second HRAs in the calendar year. These additional limits were computed as follows:

<u>Annual Rolling Average Waste Feed Rate</u>

Maximum = arithmetic mean of the highest HRAs recorded in each of the three risk burn runs

= (16.1 +17.0 + 15.3 lb/min)/3 = 16.1 lb/min

<u>Annual Rolling Average Combustion Chamber Temperature</u>

Minimum = arithmetic mean of the lowest HRAs recorded in each of the three risk burn runs

= (1,635 + 1,643 + 1,636 °F)/3 = 1,638°F

<u>Annual Rolling Average Stack Gas Flow Rate</u>

Maximum = arithmetic mean of the highest HRAs recorded in each of the three risk burn runs

= (22,250 + 22,390 + 21,999 acfm)/3 = 22,213 acfm

The permit writer is referred to the generic permits contained in Attachments C through F for examples of corresponding permit language.

Notes: ____________________

EXHIBIT 5.3.5-1

PARETO DIAGRAM FOR PIC EMISSIONS

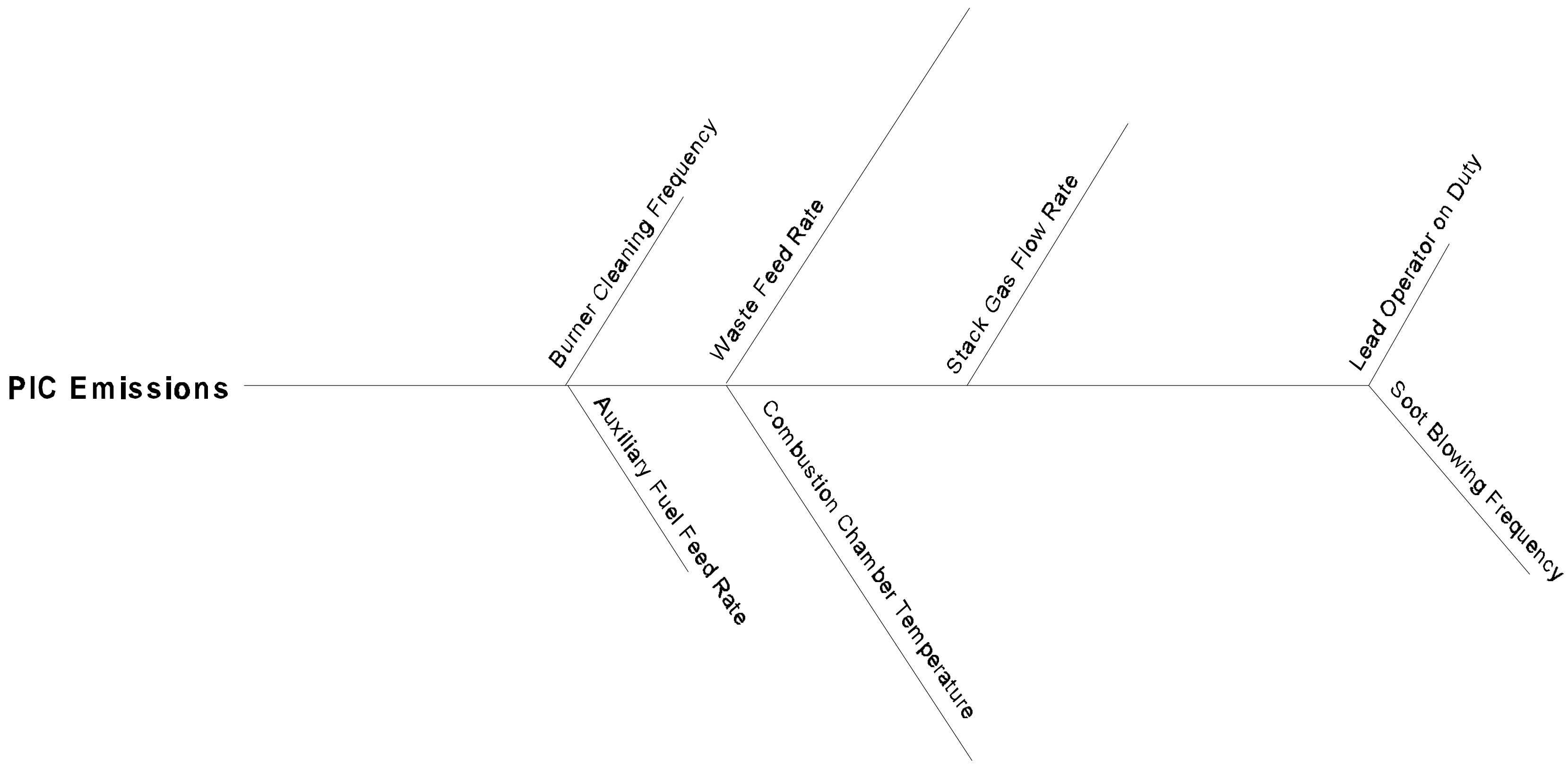

EXHIBIT 5.3.5-2

PARETO DIAGRAM FOR METALS EMISSIONS

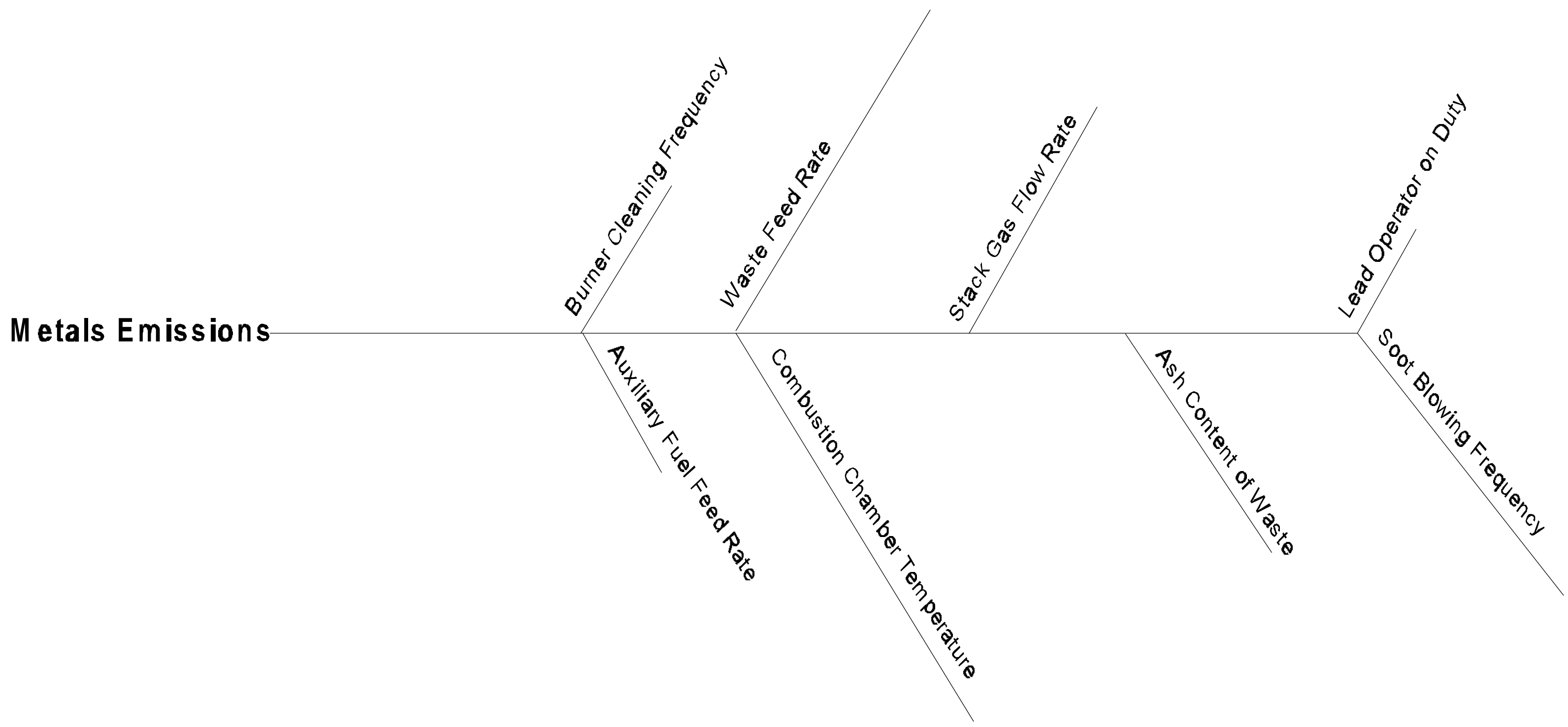

EXHIBIT 5.3.5-3

DRE AND RISK BURN PROCESS DATA SUMMARY

PARAMETER	TEST	RUN	MIN	MAX	AVERAGE
Waste Feed Rate (lb/min)	DRE	1	22.3	22.6	22.5
	DRE	2	22.5	22.5	22.5
	DRE	3	22.4	22.4	22.4
	Risk	1	13.2	16.1	16
	Risk	2	12	17	15.6
	Risk	3	11.9	15.3	13.8
Combustion Temperature (°F)	DRE	1	1585	1590	1586
	DRE	2	1586	1589	1586
	DRE	3	1585	1586	1586
	Risk	1	1635	1641	1640
	Risk	2	1643	1644	1643
	Risk	3	1636	1644	1643
Stack Gas Flow Rate (acfm)	DRE	1	30632	3122	31111
	DRE	2	30589	31542	31099
	DRE	3	30461	31874	31258
	Risk	1	21530	22250	22201
	Risk	2	21469	22390	22254
	Risk	3	20857	21999	21865

6.0 COMBUSTION UNIT CONDITIONS

Regulations: 40 CFR Parts 264.345, 266.102, 266.103, 270.21, 270.32, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: To ensure continued compliance with performance standards for DRE and metals, PM, Cl_2, and HCl emissions; and to maintain risks to human and ecological receptors below accepted thresholds, regulations require that the permit for a hazardous waste incineration facility, or BIF system, specify limits on key operating parameters. In addition to key operating parameters, the permit should include requirements for calibration, inspection, and maintenance.

The following subsections, Sections 6.1 through 6.4, describe key limits for the following units:

- Rotary kilns
- Boilers
- Liquid injection incinerators
- Halogen acid furnaces

Typical Parameters: Operating parameters that are typically addressed and recommended, unless it is inappropriate for the system or specifically exempted in the permit, are as follows.

- ❑ Monitoring and inspection procedures
- ❑ AWFCO system testing procedures
- ❑ Waste analysis procedures
- ❑ Allowable waste feed compositions
- ❑ Allowable waste feed rate
- ❑ Allowable chlorine and metals feed rates
- ❑ Device production rate
- ❑ Combustion chamber temperature
- ❑ Combustion gas flow rate
- ❑ Destruction and removal efficiency

- ❑ CO concentration in stack gas
- ❑ Hydrocarbon concentration in stack gas
- ❑ HCl, Cl_2, and metals emissions rates
- ❑ Particulate matter emissions rates
- ❑ Maximum flue gas temperature entering a particulate matter control device
- ❑ Various APCS operating procedures
- ❑ Controls on the firing system
- ❑ AWFCO system settings
- ❑ Calibration of process monitoring instruments
- ❑ Allowable variations in system design or operating procedures
- ❑ Fugitive emissions

Example: In the final permit issued by U.S. EPA in August 1996 for the AGC cement kilns, Clark included permit conditions for the following operating parameters:

<u>Kiln No. 1</u>

- DRE, 99.99 percent
- HCl emissions from both kilns combined less than 7.79 lb/hr
- Cl_2 emissions from both kilns combined less than 0.18 lb/hr
- PM emissions less than 0.08 grains per dry standard cubic foot (gr/dscf)
- Lead emissions from both kilns combined not to exceed 3.18 lb/hr
- Hexavalent chromium emissions from both kilns combined not to exceed 0.0167 lb/hr
- Cadmium emissions from both kilns combined not to exceed 0.103 lb/hr
- Arsenic emissions from both kilns combined not to exceed 0.00962 lb/hr
- HRA limits on feed rates of Cl_2, arsenic, beryllium, cadmium, chromium, and lead

- Other limits on the composition of waste feed materials
- Annual average feed rates for arsenic, beryllium, cadmium, chromium, mercury, and thallium
- Maximum HRA of CO in the stack gas not to exceed 600 ppmv
- Maximum HRA concentration of total hydrocarbons in the stack gas not to exceed 20 ppmv
- Chain section inlet gas temperature not less than 1,622°F and not greater than 2,052°F on an HRA basis
- Dry raw mix feed rate not to exceed 65 tph on an HRA basis
- Pumpable hazardous waste feed rate not to exceed 5.1 tph on an HRA basis
- Power to the ESP not less than 44.1 kilovolt ampere (kVA) on an HRA basis
- ESP inlet gas temperature not more than 388°F on an HRA basis
- Differential pressure between raw material feed hood and firing hood not greater than 1 inch water column (w.c.) on an instantaneous basis
- Differential pressure to atmosphere at the firing hood not greater than 0.01 inches w.c. for more than 60 continuous seconds
- Relative flue gas flow rate not more than 1.07 on an HRA basis
- AWFCO to activate immediately any time the above operating conditions are not met while hazardous wastes are present in the kiln

<u>Kiln No. 2</u>

- DRE 99.99 percent
- HCl emissions from both kilns combined less than 7.79 lb/hr
- Cl_2 emissions from both kilns combined less than 0.18 lb/hr
- PM emissions less than 0.08 gr/dscf
- Lead emissions from both kilns combined not to exceed 3.18 lb/hr

- Hexavalent chromium emissions from both kilns combined not to exceed 0.0167 lb/hr
- Cadmium emissions from both kilns combined not to exceed 0.103 lb/hr
- Arsenic emissions from both kilns combined not to exceed 0.00962 lb/hr
- HRA limits on feed rates of chlorine, arsenic, beryllium, cadmium, chromium, and lead
- Other limits on the composition of waste feed materials
- Annual average feed rates for arsenic, beryllium, cadmium, chromium, mercury, and thallium
- Maximum HRA of CO in the stack gas not to exceed 600 ppmv
- Maximum HRA concentration of total hydrocarbons in the stack gas not to exceed 20 ppmv
- Chain section inlet gas temperature not less than 1622°F and not greater than 2052°F on an HRA basis
- Dry raw mix feed rate not to exceed 65 tph on an HRA basis
- Pumpable hazardous waste feed rate not to exceed 5.1 tph on an HRA basis
- Power to the ESP not less than 71.0 kVA on an HRA basis
- ESP inlet gas temperature not more than 364°F on an HRA basis
- Differential pressure between raw material feed hood and firing hood not greater than 1 inch w.c. on an instantaneous basis
- Differential pressure to atmosphere at the firing hood not greater than 0.01 inches w.c. for more than 60 continuous seconds
- Relative flue gas flow rate not more than 0.98 on an HRA basis
- AWFCO to activate immediately any time the above operating conditions are not met while hazardous wastes are present in the kiln

Notes: ____

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6.1 ROTARY KILNS

Regulations: 40 CFR Parts 266.102, 266.103, and 264.345
40 CFR Parts 270.32, 270.62, and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: Rotary kilns are commonly used to incinerate hazardous wastes. Experience with rotary kilns indicates that several control parameters are critical to achievement of performance standards. These control parameters typically are addressed as Group A parameters in the permit.

Control Parameters: Common Control Parameters

- Kiln temperature. Maintained high enough for destruction of POHC and to minimize the formation of PICs, yet low enough to prevent excessive volatilization of metals
- Kiln pressure. Maintained at negative pressure relative to atmosphere to prevent kiln fugitive emissions
- Combustion gas velocity. Controlled to ensure proper combustion gas residence time and destruction of POHC
- Waste feed rate. Controlled to avoid overloading, over-pressuring, and depleting kiln oxygen (O_2) that is critical to POHC destruction
- CO and THC combustion gas concentrations. Monitored to ensure satisfactory kiln operation and to minimize PIC formation
- Minimum and maximum production rate. Controlled to ensure complete combustion
- Hazardous waste firing system controls. Controlled to ensure proper AWFCO operation
- Allowable design. Controlled to ensure complete combustion
- Operating variability. Controlled to ensure trial burn results remain representative

Potential Control Parameters

- O_2 level at kiln exit. Controlled to ensure complete combustion

- Kiln solids residence time. Controlled by kiln rotation speed, usually between 0.5 and 1.5 hours, to ensure that the waste spends enough time in the kiln to be thoroughly treated

- Kiln solids and combustion air mixing. Good mixing is promoted to assure that volatiles are completely combusted

Examples:

TXI and Ash Grove Permits - In the draft permit for the TXI cement kiln at Midlothian, Texas, Lois included permit conditions for many of the above-mentioned control parameters (see Exhibit 6.1-1, page 7-66).

Developing permit limits from trial burn data - The minimum SCC temperature is a Group A parameter. In a recent trial burn at a rotary kiln incinerator system, the run average SCC temperatures were as follows:

Run 1—2,145°F
Run 2—2,345°F
Run 3—2,360°F

The permit limit was calculated as the mean of the three run averages as follows:

$$\text{Permit limit} = \frac{2{,}145 + 2{,}345 + 2{,}360}{3} = 2{,}283^\circ\text{F}$$

Notes:

EXHIBIT 6.1-1

TXI MIDLOTHIAN PERMIT
SECTION IV

PERMIT NO. HW-50316-001
NAME: TXI Operations, LP

PERMIT SECTION IV - CEMENT KILN REQUIREMENTS

A. CEMENT KILN AREA OPERATIONAL REQUIREMENTS

1. The permittee shall feed wastes to a permitted cement kiln unit only when that unit meets the following conditions:

   a. During startup and shut-down of a permitted cement kiln, waste shall not be fed into the device unless the device is operating within the parameters specified in this permit.

   b. The combustion gas temperature measured by the thermocouple located at the feed end of the kiln (feed end temperature) is maintained above 433°F, which is considered to be representative of the minimum required kiln temperature demonstrated during testing.

   c. The temperature of the combustion gas by the thermocouple located at the feed end of the kiln (feed end temperature) is maintained below 530°F, which is considered to be representative of the maximum required kiln temperature demonstrated during testing.

   d. The maximum velocity head differential pressure through the cement kiln stack shall not exceed 0.1915 inches of H_20 as measured at the stack.

   e. The combustion gas concentration of carbon monoxide (CO) continuously measured at the stack shall not exceed 365 parts per million by volume (ppmv) when corrected to 7 percent oxygen, dry basis, in the stack gas.

      In addition, the total hydrocarbons (THC) at the stack shall not exceed 20 ppmv when corrected to 7 percent oxygen, dry basis, in the stack gas. Both the CO and the THC Continuous Emission Monitoring Systems (CEMS) shall meet the data quality requirements of <u>Provision IV.C.</u>

   f. Total emission rates of metals and chlorine while burning wastes are limited to those listed in <u>Attachment H</u>, entitled "Emission Sources - Maximum Allowable Emission Rates", which is hereby made a part of this permit. Each cement kiln is limited to the emissions specified in that attachment.

   g. The total power to the electrostatic precipitator measured on the secondary side of each transformer and totaled shall be no less than 93 kilovolt-amperes (kVA).

   h. The permittee maintains and operates an automatic waste feed cut-off system which shall activate under the conditions listed in <u>Attachment I</u>, entitled, "Waste Feed Cut-Off Systems."

   I. While feeding hazardous waste, the maximum production rate of the kiln shall not exceed 71.1 tons/hr as total raw material dry feed. While feeding hazardous waste, the minimum production rate of the kiln shall not be less than 8 tons/hr as total raw material dry feed.

   j. The flue gas entering the particulate matter control device shall have a maximum temperature of 423°F.

PERMIT NO. HW-50316-001
NAME: TXI Operations, LP

B. LIMITATIONS ON WASTES BURNED

1. The feed rate of total wastes to a cement kiln shall not exceed 257 pounds per minute (lb/min). The total pumpable waste feed rate to the a cement kiln shall not exceed 257 lb/min. The feed rate of waste as quench water shall not exceed 166 lb/min.

2. The total feed rate of metals and chlorine to each cement kiln shall not exceed the limitations set out in Attachment J, entitled “Maximum Constituent Feed Rates”, at any time.

C. OTHER CEMENT KILN MONITORING, TESTING AND INSPECTION REQUIREMENTS

1. The permittee shall monitor and record the parameters listed in Attachment K, entitled "Other Kiln Monitoring Systems."

2. Stack oxygen and carbon monoxide concentrations shall be measured using Continuous Emission Monitoring Systems (CEMS) which sample from essentially the same location in the exhaust gas stream. The CEMS shall be certified for use by meeting the design and performance specifications and passing the field tests in 40 CFR Part 266, Appendix IX, Section 2.1. Oxygen concentrations shall be quantified and reported as percent by volume (%) on a dry basis. Carbon monoxide concentrations shall be quantified and reported as parts per million by volume (ppmv), corrected to 7 percent by volume oxygen, on a dry basis.

3. The permittee shall continuously monitor the exhaust gas stream for total hydrocarbons (THC) while feeding waste to the cement kiln.

   a. The THC CEMS shall meet the design and performance specifications, pass the field tests, meet the installation requirements and the data analysis and reporting requirements of 40 CFR Part 266, Appendix IX, Section 2.2.

   b. The THC concentrations shall be reported in ppmv (dry basis) corrected to 7 percent oxygen on an hourly average basis and in pounds per hour.

4. The continuous emission monitoring systems for CO, THC and Stack Oxygen shall be zeroed and spanned daily for each monitoring range on those days when the cement kiln system is in service. Corrective action shall be taken when the 24-hour span drift exceeds two times the amount specified in 40 CFR Part 266, Appendix IX. Each calendar quarter, monitor accuracy shall be certified using a cylinder gas audit (CGA) as described in 40 CFR Part 60, Appendix F, Procedure 1, Section 5.1.2. Reference method testing can be substituted for cylinder gas audits if preferred by the permittee. Corrective action shall be taken when the CGA or reference method testing exceeds ± 15 percent accuracy. Each CO, THC and Stack Oxygen CEMS shall operate at a minimum of 90 percent uptime, based on a 24-hour period.

PERMIT NO. HW-50316-001
NAME: TXI Operations, LP

5. The waste feed cut-off system and associated alarms for each kiln shall be tested weekly to verify operability. TXI will maintain a "fail safe" valve (i.e., remains in the closed position in event of failure) on each kiln. System testing will be accomplished with an electronic loop test for the components of the system, including sensors, which test the operability of the circuit without actually closing the "fail safe" valve. The waste feed cut-off valve shall be activated once during the weekly inspection. A check of every input to the waste feed cut-off system does not have to activate the waste feed cut-off. If the waste feed cutoff system "trips" (i.e., waste feed is cut off due to a process operations excursion from specified limits) during the 7-day period prior to testing, the actual trip will satisfy the need to test the valve. In addition, a complete inspection and function test shall be performed on all system alarms and emergency control devices at least annually.

6. The monitoring and inspection data collected in Provisions IV.D.1.-6. shall be recorded and the records shall be placed in the operating log as required by 40 CFR §266.102(10). In addition to the specific requirements of that paragraph, the permittee shall also record:

   a. All occasions when waste is being fed to the cement kiln unit and the operating limits specified in Provision IV.B. are exceeded and/or;

   b. All occasions when waste feed is cut off by the automatic waste feed cut-off system, including the date, time and parameter that triggered the cut-off.

7. The permittee will continue to maintain the voluntary real time electronic data link with the TNRCC Region 4 Office. The link will provide access to the following operational data: THC, ppm, corrected to 7 percent O_2; CO, ppm, corrected to 7 percent O_2; SO_2, ppm, corrected to 7 percent O_2; NO_x, ppm, corrected to 7 percent O_2; Stack Opacity, percent; Stack Temperature, °F; Stack Velocity, in. H_2O; and kiln O_2, percent. In addition, the system will indicate whether hazardous waste or quench water is being fired. The permittee may upgrade the components of this system or add additional parameters with concurrence with the TNRCC Region 4 Office. TXI will not be held responsible for loss of the linkage due to weather, or other reasons beyond TXI control.

D. CEMENT KILN SAMPLING REQUIREMENTS

1. The permittee may conduct additional trial burn testing in accordance with a trial plan approved by the Executive Director. The results from the additional trial burn testing shall be used for the purpose of determining the feasibility of compliance with the performance standards of 40 CFR §§266.104 through 266.107 and of determining adequate operating conditions under 40 CFR §266.102(e). The permittee may request a permit modification or amendment pursuant to 30 TAC §305.69 or §305.62 based on these additional trial burn results.

2. Upon request of the Executive Director of the TNRCC, additional sampling and analysis of the waste and exhaust emissions shall be conducted to verify that the operating requirements of Provisions IV.B. and IV.C. of this permit achieve the performance standards of 40 CFR §§266.104 through 266.107 as referenced in this permit.

6.2 BOILERS

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Parts 270.32 and 270.66

Guidance: No specific references are applicable to this section of the manual.

Explanation: Boilers are commonly used to incinerate liquid hazardous wastes. Boilers come in a variety of sizes, configurations, and designs. Common types of boilers include fire tube, water tube, and stoker-fired.

Control Parameters: Common Control Parameters

- Combustion chamber temperature. Maintained at the maximum temperature to minimize PIC formation, yet low enough to prevent excessive metals volatilization

- Combustion chamber pressure. Maintained at negative pressure relative to the atmosphere to prevent fugitive emissions

- Combustion gas velocity. Controlled to ensure proper combustion gas residence time and POHC destruction

- Waste feed rate. Controlled to avoid overloading, over-pressuring, and depleting O_2 that is critical to the POHC destruction

- CO and THC combustion gas concentrations. Monitored to ensure satisfactory boiler operation and to minimize PIC formation

- Feed rates of the BIF-regulated metals. Controlled below levels that could pose unacceptable risks to human and ecological receptors

- Feed rates of chlorine and chloride. Controlled below levels that could pose unacceptable risks to human and ecological receptors

- Feed rates of ash. Controlled below levels that could lead to excessive PM emissions

- Maximum flue gas temperature entering the PM control device. Controlled below levels that could deteriorate PM collection efficiency. Controlled below levels that are conducive to dioxin and furan formation

- Other Combustion and APCS Control Parameters. Controlled as needed to ensure adequate DRE and reduce risks posed by emissions of metals and PICs

- Minimum and maximum production rate. Controlled to ensure complete combustion
- Hazardous waste firing system controls. Controlled to ensure proper AWFCO operation
- Allowable design. Controlled to ensure complete combustion
- Operating variability. Controlled to ensure trial burn results remain representative

Potential Control Parameters

- Excess O_2 level in combustion chamber. Controlled to ensure complete combustion
- Waste feed solids content. Controlled below levels that could deteriorate burner performance
- Waste feed viscosity. Controlled below levels that could deteriorate burner performance
- Atomizing fluid pressure. Maintained at a prescribed differential above that of the waste feed to ensure proper waste feed atomization
- Steam production rate. Maintained below maximum levels and above minimum levels demonstrated in certification tests and trial burns
- Emissions rates of metals, HCl and Cl_2. Controlled below levels that could pose unacceptable risks to human and ecological receptors.
- Feed rates of auxiliary fuels. Controlled within a range that optimizes combustion and minimizes PIC formation.

Examples: U.S. EPA has not yet written a final permit for a boiler; however Lois and Clark will address the above parameters in developing facility-specific permit conditions.

During a recent trial burn at a boiler, the differential pressure between the atomizing fluid (steam) and the waste liquid feed was measured and recorded as shown in the table below.

Run Number	Differential Pressure (pounds per square inch gauge)		
	Mean	Maximum	Minimum
1	45.0	45.0	45.0
2	45.0	45.0	45.0

3	45.0	45.0	45.0
4	45.19	45.0	46.0
5	45.90	45.0	46.0
6	45.87	45.0	46.0

The atomizing fluid differential pressure is a Group C parameter for which permit limits (in this case a minimum) are based on manufacturers' recommendation. The manufacturer of the burner system recommended a minimum differential pressure of 15 psig. The trial burn data show that this recommendation was met during all six runs. The permit limit will be a minimum of 15 psig, even though a much higher differential pressure was demonstrated.

During the same trial burn, steam production rates were as follows:

Run Number	**Steam Production (pounds per hour)**		
	Average	**Minimum**	**Maximum**
1	207,120	202,500	210,000
2	206,730	200,000	210,000
3	205,770	205,000	210,000

The permit limit for maximum steam production was calculated as follows:

$$\text{Limit} = \frac{207{,}120 + 206{,}730 + 205{,}770}{3} = 206{,}540 \text{ lb/hr}$$

Notes: ____________________

6.3 LIQUID INJECTION INCINERATORS

Regulations: 40 CFR Parts 270.32 and 270.62

Guidance: No specific references are applicable to this section of the manual.

Explanation: Liquid injection incinerators are commonly used for incinerating liquids, slurries, and sludges. Highlighted parameters are commonly included in liquid injection incinerator permits.

Control Parameters: Common Control Parameters

- Combustion chamber temperature. Maintained at the maximum temperature to minimize PIC formation, yet low enough to prevent excessive metals volatilization

- Combustion chamber pressure. Maintained at negative pressure relative to the atmosphere to prevent fugitive emissions

- Combustion gas velocity. Controlled to ensure proper combustion gas residence time and POHC destruction

- Waste feed rate. Controlled to avoid overloading, over-pressuring, and depleting O_2 that is critical to POHC destruction

- CO and THC combustion gas concentrations. Monitored to ensure satisfactory boiler operation and to minimize PIC formation

- Feed rates of the BIF-regulated metals. Controlled below levels that could pose unacceptable risks to human and ecological receptors

- Feed rates of chlorine and chloride. Controlled below levels that could pose unacceptable risks to human and ecological receptors

- Feed rates of ash. Controlled below levels that could lead to excessive PM emissions

- Maximum flue gas temperature entering the PM control device. Controlled below levels that could deteriorate PM collection efficiency controlled below levels that are conducive to dioxin and furan formation

- Other Combustion and APCS Control Parameters. Controlled as needed to ensure adequate DRE and reduce risks posed by emissions of metals and PICs

Potential Control Parameters

- Excess O_2 level in combustion chamber. Controlled to ensure complete combustion

- Waste feed solids content. Controlled below levels that could deteriorate burner performance

- Waste feed viscosity. Controlled below levels that could deteriorate burner performance

- Atomizing fluid pressure. Maintained at a prescribed differential above that of the waste feed to ensure proper waste feed atomization

- Emissions rates of metals, HCl and Cl_2. Controlled below levels that could pose unacceptable risks to human and ecological receptors

- Feed rates of auxiliary fuels. Controlled within a range that optimizes combustion and minimizes PIC formation

Example: Lois included the above control parameters in developing incinerator permit conditions for ANCFD (see Attachment P, Section VII.B).

Notes: ____

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6.4 HALOGEN ACID FURNACES

Regulations: 40 CFR Parts 270.32 and 270.62

Guidance: No specific references are applicable to this section of the manual.

Explanation: The halogen acid furnace (HAF) is a special form of liquid injection incinerator that produces an aqueous acid "product" in the off-gas treatment system. A typical process flowsheet for a HAF is shown on Exhibit 6.4-1 (see page 7-77).

The HAF is a unique form of hazardous waste combustion system because acid is recovered from the off-gas for reuse or sale. From a systems viewpoint, however, the HAF is basically a liquid injection incinerator with a multi-stage wet scrubber system. Therefore, it should be possible to develop permit conditions for the HAF based on the concepts presented in Sections 6.3 (Liquid Injection Incinerators) and 7.5 (Wet Scrubbers). The wet scrubber system in the HAF, however, is operated to produce an acidic liquid with economic value. To this end, it may not be appropriate to impose limits on all of the control parameters identified in Section 7.5 for each stage of the wet scrubber system. In particular, it may be necessary to waive permit conditions for liquid-to-gas ratios and pressure drops in the absorber sections of the off-gas treatment train to permit the facility to optimize its acid recovery process and to impose such limits only on the final off-gas cleaning stages.

Control Parameters: The control parameters for the combustion process should be similar to those for a liquid injection incinerator as listed below:

Common Control Parameters

- Minimum and maximum combustion chamber temperature
- Maximum combustion chamber pressure
- Maximum combustion gas velocity
- Maximum waste feed rate
- Maximum feed rates of ash, metals, chlorine, and chloride
- Maximum emissions of PM, metals, chlorine, and chloride
- Maximum CO and hydrocarbon levels in the stack gas

Potential Control Parameters

- Minimum excess oxygen level in combustion chamber
- Maximum waste feed solids content
- Maximum waste feed viscosity
- Minimum atomizing fluid pressure
- Other parameters as needed to ensure DRE and control emissions of metal and PICs

When crafting permit limits for the off-gas treatment train, the permit writer should concentrate on control parameters that have the greatest effect on the following emissions rates:

- PM, HCl, and chlorine
- Metals
- PICs

To determine which control parameters have the greatest effect on the above emissions rates, it is recommended that the permit writer construct Pareto diagrams, as introduced in Section 5.3.5.

Example: A trial burn was recently conducted at a HAF. The process flow diagram for this facility is shown on Exhibit 6.4.1 (see page 7-77). Lois and Clark determined that the control parameters for the combustion subsystem of the HAF should be as follows:

- Minimum combustion chamber temperature to ensure DRE
- Maximum combustion chamber temperature to minimize metals volatilization
- Maximum combustion chamber pressure to minimize fugitive emissions
- Maximum combustion gas velocity to ensure DRE
- Maximum waste feed rate to ensure DRE
- Maximum feed rates of ash, metals, chlorine, and chloride to control emissions of PM, metals, chlorine, and chloride
- Maximum emissions of PM, metals, chlorine, and chloride to ensure compliance with regulatory performance standards and control risks to human health and the environment
- Maximum CO level in the stack gas to ensure compliance with the regulatory performance standard and minimize the emissions of PICs
- Minimum excess oxygen level in combustion chamber to ensure DRE
- Maximum waste feed solids content to prevent plugging of the waste feed nozzles
- Maximum waste feed viscosity to ensure proper atomization of waste feed and DRE
- Minimum atomizing fluid pressure to ensure proper atomization of waste feed and DRE

Lois constructed the Pareto diagrams shown on Exhibits 6.4-2 (see page 7-78), -3 (see page 7-79), and -4 (see page 7-80) as a first step in establishing the list of off-gas treatment train control parameters that will be subject to permit limits. Based on Lois's work, it was determined that the following off-gas treatment control parameters would be subject to permit limits:

- Minimum liquid-to-gas ratio in the vent scrubber and the final scrubber to optimize particulate and acid gas capture and control emissions of PICs and metals
- Maximum off-gas flowrate entering the vent scrubber and the final scrubber to optimize particulate and acid gas removal and control emissions of PICs and metals
- Minimum pH of scrubber liquid entering the final scrubber to ensure adequate acid gas and metal removal
- Minimum blowdown rate from the final scrubber to ensure control of PM and acid gases

Based on information contained in the equipment manufacturer's operations manual for the off-gas treatment train, Clark imposed the following additional Group C permit limits:

- Maximum combustion gas temperature entering the primary absorber to prevent damage to downstream equipment in the APCS train.

Notes:

EXHIBIT 6.4-1

HALOGEN ACID FURNACE PROCESS FLOW DIAGRAM

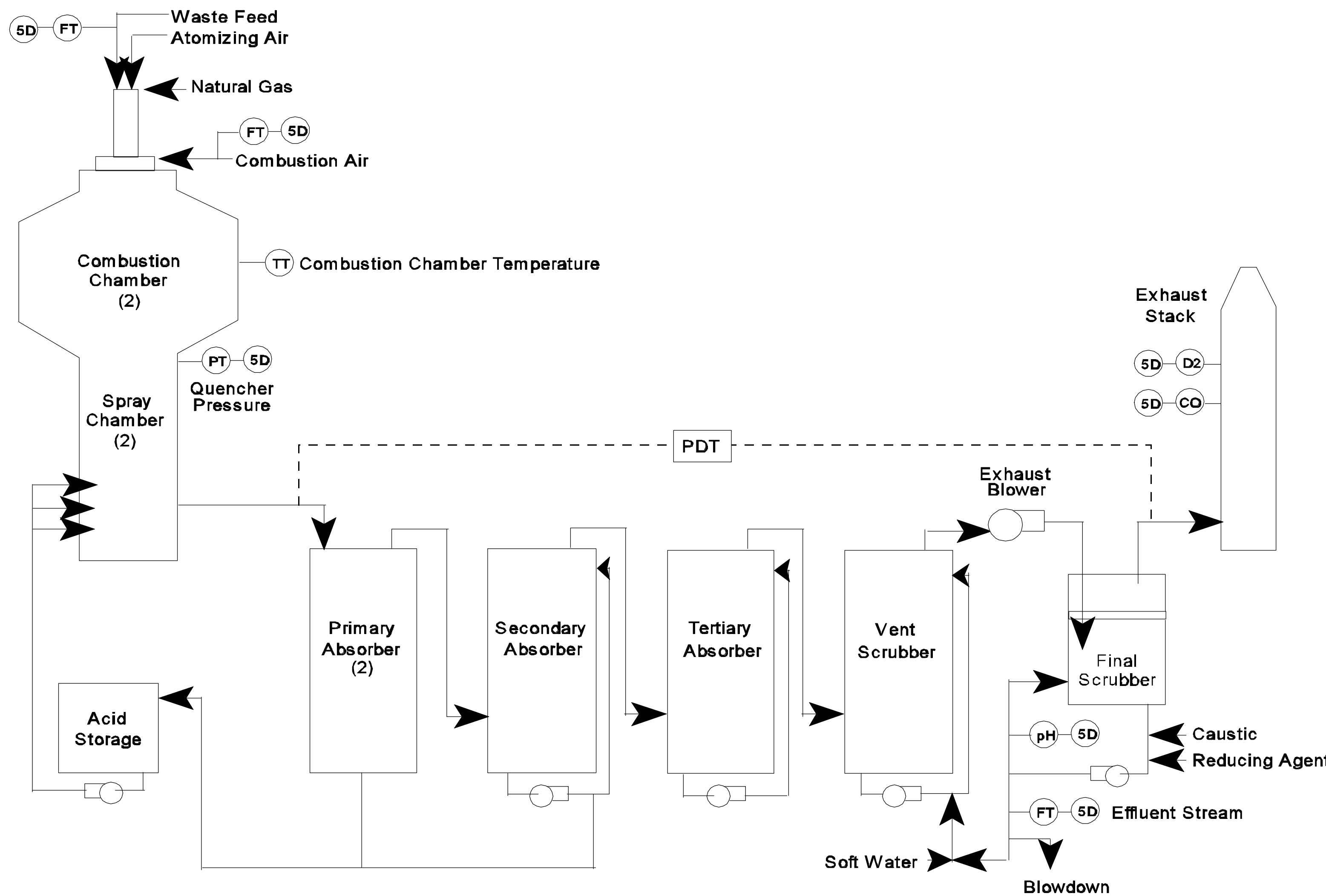


EXHIBIT 6.4-2

PARETO DIAGRAM FOR HAF OFF-GAS TREATMENT TRAIN OPERATING CONDITIONS RELATED TO PIC EMISSIONS

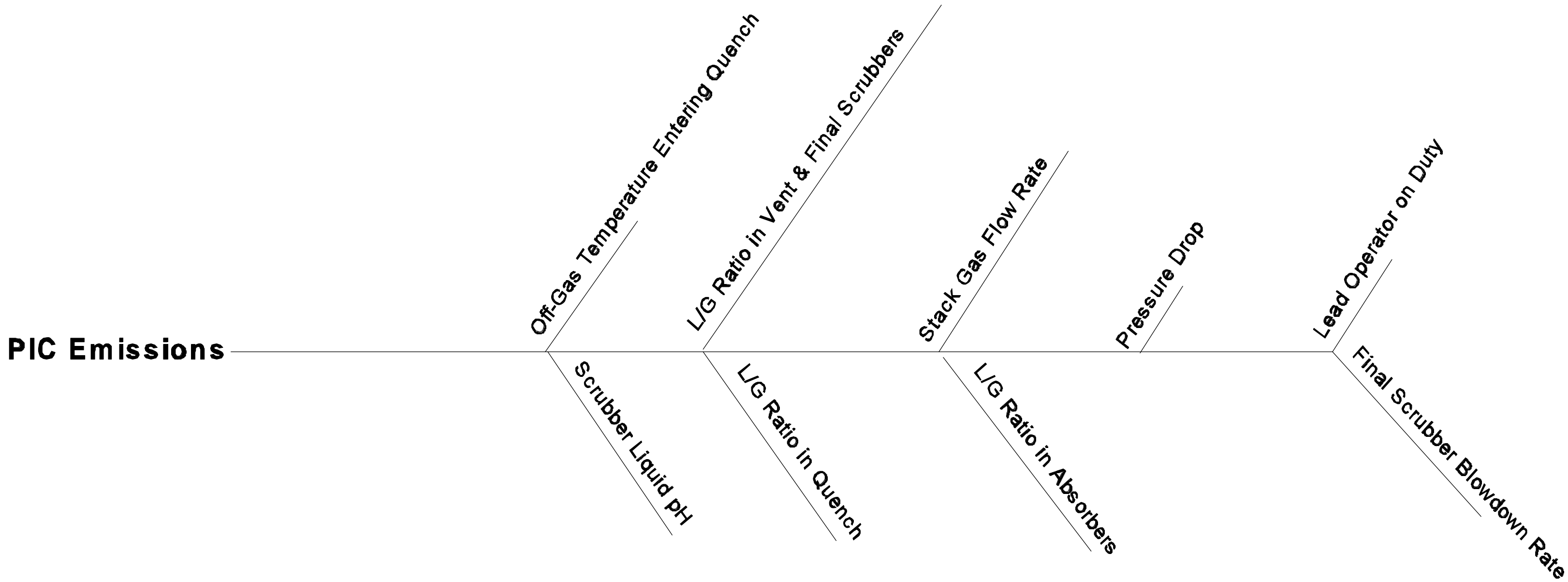


EXHIBIT 6.4-3

PARETO DIAGRAM FOR HAF OFF-GAS TREATMENT TRAIN OPERATING CONDITIONS RELATED TO PM, HCl, Cl_2 EMISSIONS

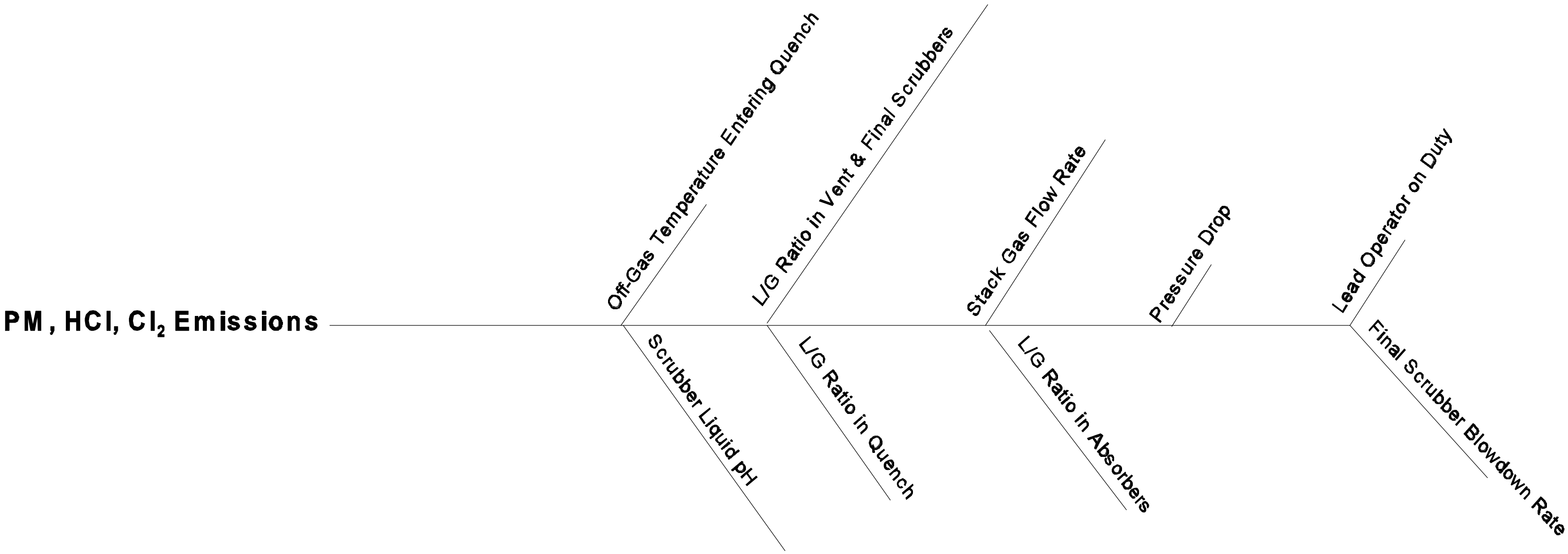
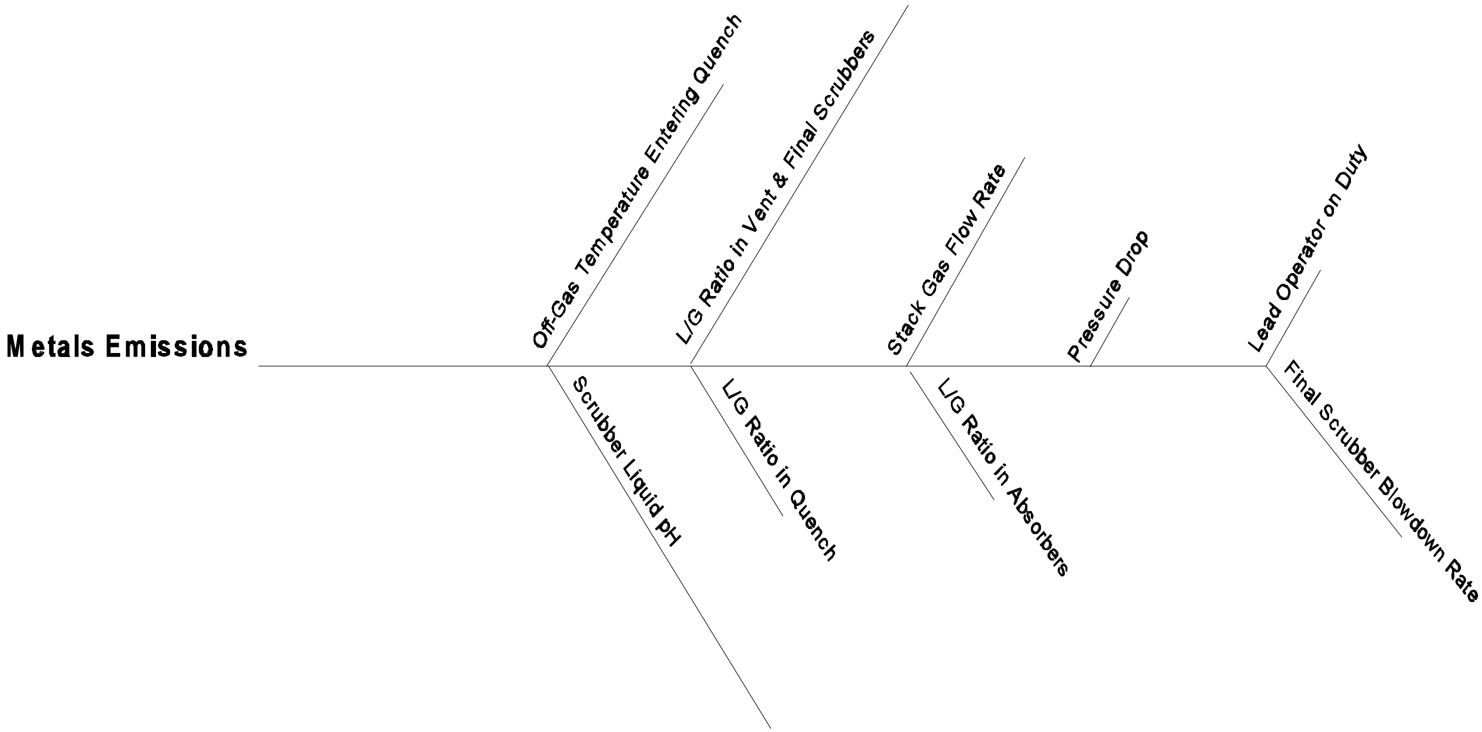


EXHIBIT 6.4-4

PARETO DIAGRAM FOR HAF OFF-GAS TREATMENT TRAIN OPERATING CONDITIONS RELATED TO METALS EMISSIONS



7.0 AIR POLLUTION CONTROL SYSTEM CONDITIONS

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: APCS at hazardous waste combustion facilities generally serve two purposes—control of particulate emissions and organic and acid gases.

APCS generally consist of two types—wet and dry. Wet systems are predominant among older incinerators; dry systems are common at BIF units, particularly cement kilns and newer incinerators.

Wet APCS are typically comprised of several combinations and configurations of the following types of units: quench chambers, packed-bed scrubbers, venturi scrubbers, and mist eliminators. Dry APCS typically consist of a mechanical collector (for example, cyclone) followed by either a fabric filter baghouse and ESP or a spray-drying absorber.

Most hazardous waste combustion systems are equipped with APCS. These APCS range in complexity from simple ESPs at some of the older hazardous waste burning cement kilns to more sophisticated systems that include quench columns, venturi scrubbers, demisters, and fabric filter baghouses at modern commercial incineration plants.

On the other hand, many hazardous waste burning boilers have no APCS. This is due mainly to the very low ash content of the wastes being burned. As a result, the potential for PM emissions is low.

The specification of operating conditions for APCS typically involves a combination of Group A, B, and C parameters. Specification of operating conditions frequently requires balancing equipment manufacturers' recommendations with the results of trial burn tests. The specification of operating conditions depends on the manner in which the parameter is monitored and recorded. In addition to operating conditions, the permit writer should specify requirements for calibration, inspection, and maintenance of the APCS.

Approaches: The following subsections describe control parameters for various APCS:

- ❑ Quench systems (Section 7.1)
- ❑ Fabric filter baghouses (Section 7.2)
- ❑ Electrostatic precipitators (Section 7.3)
- ❑ Venturi scrubbers (Section 7.4)

- ❑ Wet scrubbers (Section 7.5)

Examples: Specific examples are provided in Sections 7.1 through 7.4.

Notes: ______________________________

7.1 QUENCH SYSTEMS

Regulation: 40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: Quench systems are common components of combustion unit systems. They serve to rapidly cool combustion gases exiting the PCCs and SCCs. By facilitating rapid cooling of combustion gases, they play a key role in inhibiting the postcombustion formation of dioxins, furan, and other undesirable PICs and protecting downstream air pollution control equipment from damage caused by excessive combustion gas temperature.

Control Parameters: The following control parameters are recommended for inclusion in the permit.

- <u>Combustion gas inlet temperature</u>. Maintained below maximum levels specified by the manufacturer to ensure that the unit's thermal rating is not exceeded

- <u>Combustion gas flow rate.</u> Maintained below maximum levels specified by the manufacturer and demonstrated in trial burns to ensure that the residence time of the combustion gas within the quench system is sufficient to produce adequate cooling

- <u>Combustion gas exit temperature.</u> Maintained below maximum levels specified by the manufacturers of downstream APCS equipment and demonstrated in trial burns to ensure proper operation of downstream APCS equipment

- <u>Quench water flow rate.</u> Maintained high enough to ensure adequate cooling of combustion gases

- <u>Quench water inlet temperature.</u> Maintained low enough to ensure adequate cooling of combustion gases

- <u>Quench water pH</u>. Maintained within range recommended by the manufacturer to ensure proper operation

- <u>Quench water total suspended solids</u>. Maintained below levels that could negatively affect unit performance

Examples: **<u>Consolidated Incineration Facility</u>**

The APCS for the CIF incinerator consists of a quench chamber, a steam-atomized free-jet scrubber (venturi-type), a cyclone separator, a mist eliminator, a reheater, and a high efficiency particulate air (HEPA) filter.

The operating limit and corresponding AWFCO set point for the CIF quench system are examples of Group C parameters that are interlocked with the AWFCO system. The operating limit and AWFCO set point were based on the manufacturer's recommendations, independent of trial burn results.

The permit for the CIF incinerator specifies the following operating limits for the quench system:

- "The total quench liquid flow rate, monitored as specified in permit condition IIIE4.G, shall not be less than a minimum of 150 gpm

- The maximum outlet temperature from the quench chamber shall be 210°F, monitored as specified in permit condition IIIE4.G.

- The total dissolved solids in the liquid provided to the quench...shall not be greater than 10 percent by weight.

- The total suspended solids in the liquid provided to the quench...shall not be greater than 3 percent by weight.

In the CIF permit, Clark included the requirement that the quench liquid flow rate be interlocked with the AWFCO to initiate cutoff of all waste feed streams in the event that the flow rate drops below 150 gpm.

Notes: ____
____
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7.2 FABRIC FILTER BAGHOUSES

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: Fabric filter baghouses are used to remove suspended PM from combustion gases.
There are different kinds of baghouses; however, they all provide the same basic function and require similar operating limits**.**

A Pulse Jet Baghouse

Control Parameters: Common Control Parameters

- Combustion gas inlet temperature. Maintained above the dew point of the combustion gas but below temperatures that are conducive to dioxin formation (for example, usually maintained below 400°C).

- Pressure drop across the filter. Maintained in the range that optimizes PM removal (for example, 1 to 6 inches w.c.).

Potential Control Parameters

- Gas-to-cloth ratio. Maintained in the range recommended by the manufacturer to optimize particulate matter removal (usually 2 to 5 acfm per square foot of fabric).

- Cleaning frequency. Filters are cleaned periodically based on useage rate and manufacturers recommendations to ensure proper unit operation.

Examples:

A pulse jet baghouse has been installed to control particulate emissions from a boiler. Design specifications are as follows:

Total Cloth Area—3,667 $feet^2$
Air-to-Cloth Ratio—4.5:1 maximum
Pressure Drop—0.5 to 6 inches w.c.
Bags—Nomex felt, service to 375°F maximum

Test data from three runs of the trial burn are provided in Attachment N and summarized below.

Run No.	Baghouse Inlet Temperature (°F)	Gas Flow (acfm)	Differential Pressure (inches w.c)
1	328	15,480	0.53
2	316	15,404	0.52
3	313	15,227	0.56

Based on the trial burn data, the inlet temperature was observed to be within the service temperature of the bags. The air-to-cloth ratio was as follows:

$$\frac{15{,}370 \text{ acfm}}{3{,}667 \text{ feet}^2} = 4.19:1$$

This ratio is within the design specifications.

The average differential pressure was 0.54 inches w.c., also within the design specifications.

Permit conditions related to baghouse operations normally are Group C parameters established on the basis of the design specification, although dioxin formation considerations enter into the process when temperatures higher than 400°F are encountered. In this case, the permit writer has three basic options when developing permit conditions:

(1) Stick with the design specifications.

(2) Use the trial burn results to set all of the permit limits.

(3) Use a combination of design specifications and trial burn results.

Based on engineering judgment, the permit writer chose the third option and wrote the permit limits as follows:

Maximum baghouse inlet temperature	=	319°F (trial burn data)
Maximum air-to-cloth ratio	=	4.19:1 (trial burn data)
Minimum differential pressure	=	0.5 inches w.c. (design specifications)
Maximum differential pressure	=	6 inches w.c. (design specifications)

Notes:

7.3 ELECTROSTATIC PRECIPITATORS

Regulations: 40 CFR Parts 266.102 and 266.103
40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: ESPs are commonly found at hazardous waste-burning cement kilns. The designs and control logics for ESPs vary widely. Some systems are controlled on the basis of electrical amperage or power consumption in one or more chambers. Others are controlled only on the basis of applied secondary voltage. Still others are controlled by modern programmable logic controllers (PLC) that employ "fuzzy" logic that flip-flops between all of the above control schemes.

Most ESPs are limited in terms of the maximum gas inlet temperature based on manufacturers' recommendations and dioxin formation considerations.

No single method exists to prescribe operating limits for ESPs. Limits should be established only after consideration of recommendations by U.S. EPA, ESP control system manufacturers and plant operators, and on trial burn results.

Large ESP at an Electric Utility Facility

Control Parameters: Common Control Parameters

- Combustion gas flow rate. Controlled within the specific collection area of the unit
- Inlet gas temperature. Controlled to maximize metals removal and minimize dioxin/furan formation
- Power input or applied secondary voltage (kVA). Controlled within the range that optimizes particulate matter collection

Potential Control Parameters

- Rapper intensity. Controlled to minimize the re-entrainment of collected particles

Examples: **Ash Grove Cement Company, Chanute, Kansas**

Lois elected to limit ESP operation on the two kilns at the AGC on the basis of power consumption, inlet gas temperature, and flue gas flow rate. The resulting permit conditions for Kiln No. 1 are as follows:

- "The power to the ESP, monitored as specified in Permit Condition E.8 shall not be less than 44.1 kVA on an HRA basis, as defined in 40 CFR 266.102(e)(6)(I)(B).
- The maximum ESP inlet gas temperature monitored as specified in Permit Condition E.8 shall not be more than 388°F on an HRA basis, as defined in 40 CFR 266.(e)(6)(I)(B).
- The relative flue gas flow rate, monitored as specified in permit Condition E.8, shall not be more than 1.07, on an HRA basis, as defined in 40 CFR 266.(e)(6)(I)(B)."

In the permit, Lois required that the three parameters discussed above be interlocked with the AWFCO system.

Three features of these operating limits deserve further discussion. First, the limits are based on HRAs, primarily because these parameters experience substantial variation under normal operations. Second, flue gas flow rate is measured indirectly; this is common. Last, most facilities use one or more of the following types of instruments to determine stack gas velocities or volumetric flow rates:

Orifice place—differential pressure is an indicator of velocity

Pitot tubes —differential pressure is an indicator of velocity

Annubars—provide velocity indication

Fan power or speed—provides indication of volumetric flow rate

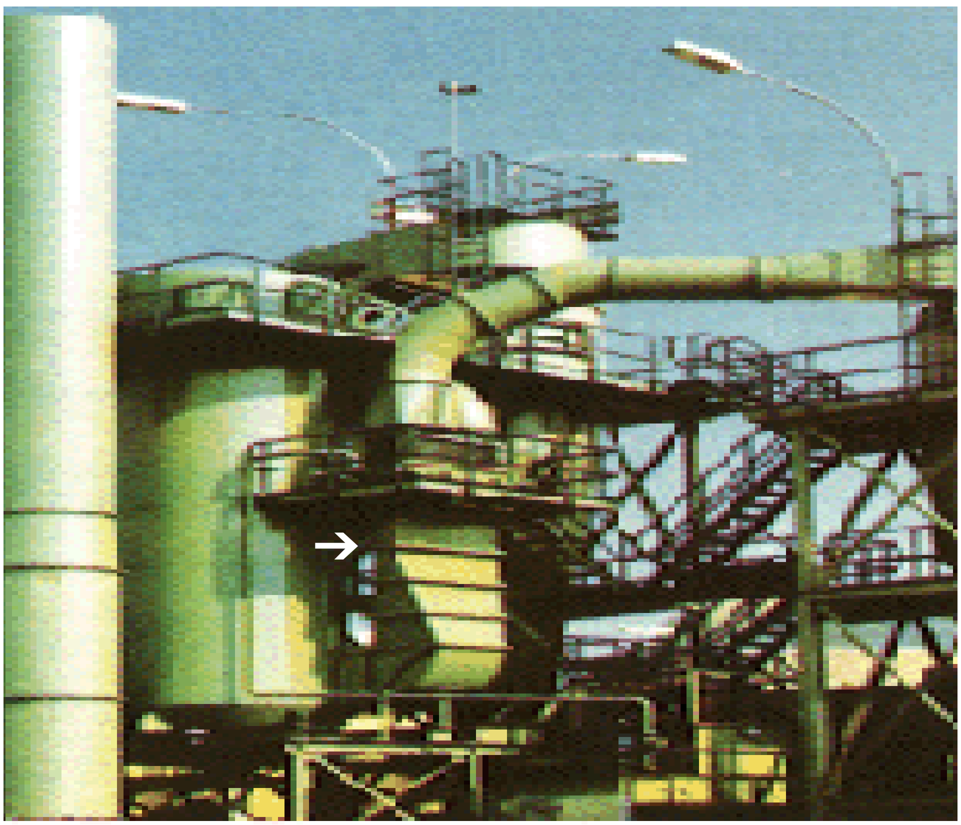
Notes:

7.4 VENTURI SCRUBBERS

Regulation: 40 CFR Parts 266.102 and 266.103
40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: Venturi scrubbers are the most common type of scrubber used for particulate control. Venturi scrubbers are also used occasionally for the control of acid gases or metal emissions downstream of an ESP or fabric filter baghouse.



Venturi Scrubber at a Chemical Manufacturing Facility

Control Parameters: Common Control Parameters

- Scrubber gas flow rate. Controlled in proportion to scrubber liquid flow rate to optimize venturi performance

- Scrubber liquid flow rate. Controlled in proportion to scrubber gas flow rate to optimize venturi performance

- Minimum liquid to gas ratio. Controlled to optimize particulate and HCl removal

- Minimum Scrubber Blowdown or Maximum Total Solids Content of Scrubber-Liquid. Controlled to optimize particulate and HCl removal.

- Pressure drop. Maintained above a minimum to optimize particle capture and HCl removal

- Scrubber liquid pH. Controlled within a range that prevents corrosion of the device at the low end of the range and scaling at the high end of the range. When used for acid gas control, maintained above a predetermined value to ensure acid gas neutralization

Potential Control Parameters

- Scrubber inlet gas temperature. Maintained below a maximum value to prevent scrubber liquid evaporation

Examples: In the XYZ Company incinerator permit, Clark includes Group C operating limits for a high-energy venturi scrubber. The pertinent permit section reads as follows:

- "Each incineration train shall be equipped with a high energy venturi scrubber which shall be used for the control of PM in the combustion gases during the incineration of waste. No waste material shall be incinerated in either incineration train if the venturi scrubber associated with that train is not operational.

- Each venturi scrubber shall be designed and operated so as to achieve at all times a minimum of 99 percent efficiency in the removal of PM and a minimum of 99 percent efficiency in the removal of metals except mercury.

- The scrubber liquid injection rate to the venturi scrubber measured immediately prior to injection shall be maintained at an average of 900 gallons per minute (gpm) on an hourly basis and shall not go below 500 gpm at any time. The scrubber injection rate shall be monitored on a continuous basis [sic] and shall be recorded continuously.

- The overall pressure drop across each venturi scrubber shall be greater than 55 inches of w.c. at all times during the incineration of waste. The pressure drop across the inlet and outlet scrubber [sic] shall be monitored on a continuous basis and shall be recorded continuously.

The scrubber liquid injection rate in this case is limited on both average and instantaneous bases.

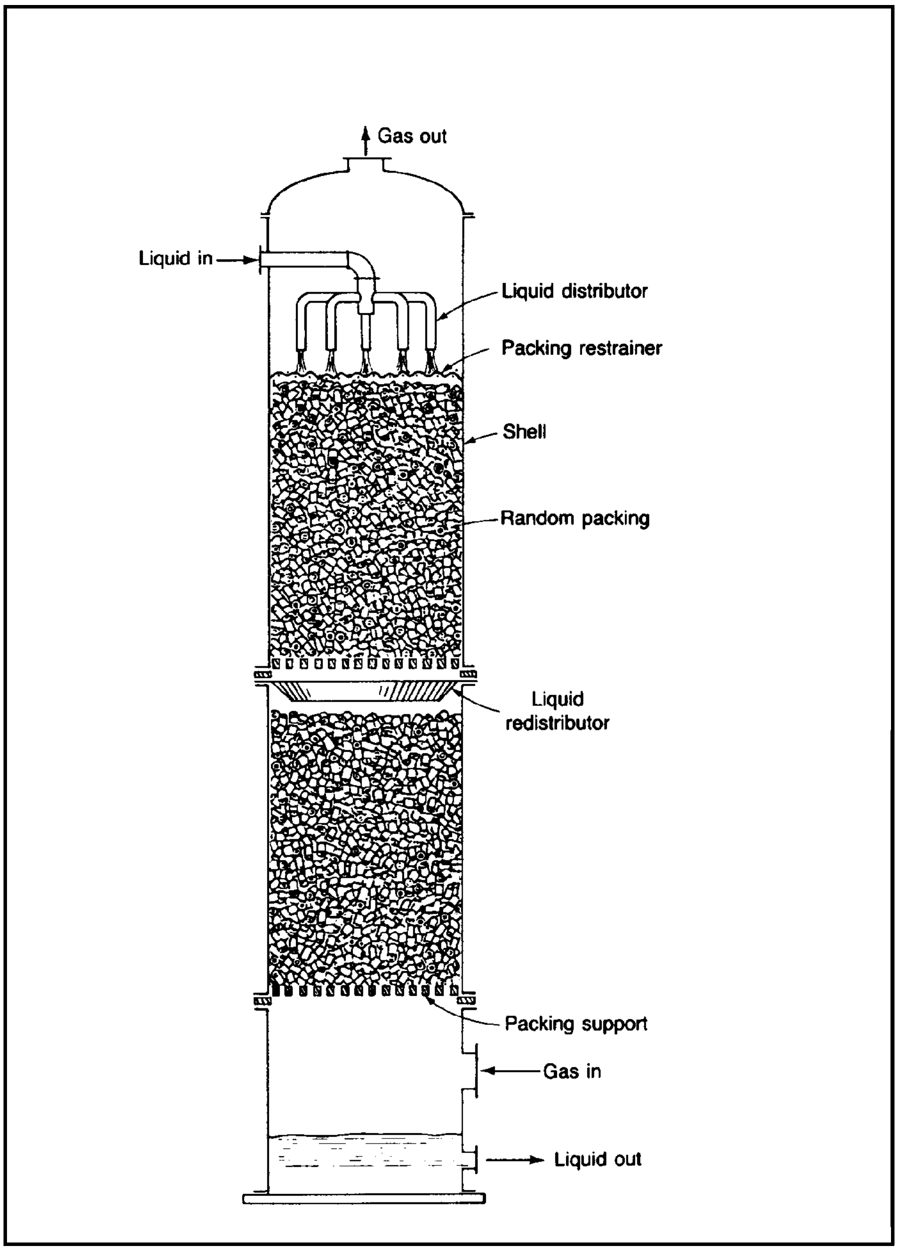
Notes: ____

7.5 WET SCRUBBERS

Regulation: 40 CFR Parts 266.102 and 266.103
40 CFR Part 270.32

Guidance: No specific references are applicable to this section of the manual.

Explanation: Wet scrubbers are commonly used for controlling emissions of PM, acid gases, and metals. Wet scrubber designs are diverse and include packed columns, plate towers, and venturis. Some wet scrubber designs also include ionizing sections.



Schematic of a Packed Bed Wet Scrubber

Control Parameters: Common Control Parameters

- Scrubber gas flow rate. Controlled in proportion to scrubber liquid flow rate to optimize scrubber performance

- Scrubber liquid flow rate. Controlled in proportion to scrubber gas flow rate to optimize scrubber performance

- Minimum liquid to gas ratio. Controlled to optimize PM and HCl removal

- Scrubber blowdown. Controlled above a certain rate to ensure control of PM and acid gases.

- Suspended solids. Controlled below a certain level to ensure optimum scrubber performance.

- Scrubber liquid pH. Controlled within a range that prevents corrosion of the device at the low end of the range and scaling at the high end of the range. When used for acid gas control, pH is maintained above a predetermined value to ensure acid gas neutralization

Potential Control Parameters

- Scrubber inlet gas temperature. Maintained below a maximum value to prevent evaporation of the scrubber liquid

- Pressure drop. Maintained above a minimum to optimize particle capture

Examples: In the permit for the XYZ Company, Lois includes operating limits for primary and secondary packed-bed scrubbers. The relevant permit language is as follows:

- "The primary packed scrubber associated with each incineration train shall achieve at all times a minimum of 99 percent efficiency in the removal of HCl from the effluent gas stream.

- The solvent stream flow rate through each primary scrubber measured at the inlet to each scrubber shall be maintained at a minimum of 3,500 gpm in each absorber on a rolling hourly average and shall not go below 3000 gpm at any time. The solvent stream flow rate shall be monitored on a continuous basis and shall be continuously recorded.

- The temperature of the outlet gas from each primary packed bed absorber measured at the gas outlet from the primary packed bed scrubber shall not exceed 135°F at any time. This temperature shall be monitored on a continuous basis and shall be continuously recorded.

The secondary packed scrubbers on each train shall achieve at all times a minimum of 99 percent efficiency in the removal of HCl, a minimum of 99 percent efficiency in the removal of sulfur oxides, and a minimum of 85 percent efficiency in the removal of oxides of nitrogen from the effluent gas stream.

- The solvent stream flow rate through the secondary scrubbers measured at the inlet of each stage of the secondary scrubber shall be maintained at a minimum of 2,000 gpm in each stage, on a rolling hourly average, and shall not go below 1,500 gpm at any time. The solvent stream flow rate shall be monitored on a continuous basis and shall be continuously recorded.

- Sodium hydroxide shall be added to the solvent fed to the second and third stages of each secondary scrubber so as to maintain a pH of 8 and 11, respectively, on an hourly average. The pH of these feed streams shall be monitored on a continuous basis and shall be continuously recorded.

Notes: ______________________________

8.0 MISCELLANEOUS CONDITIONS

Regulation: 40 CFR Parts 264 Subpart X, 270.23, and 270.27; Clean Air Act (CAA)

Guidance: No specific references are applicable to this section of the manual.

Explanation: In some instances, miscellaneous units that are regulated under 40 CFR Part 264 Subpart X may be collocated with integrated hazardous waste combustion facilities. Also, it is sometimes desirable to consolidate the RCRA and air pollution permitting tasks. In these instances, a joint RCRA/CAA permit is issued.

Check For: The following subsections describe various miscellaneous conditions:

- ❑ Miscellaneous units (Section 8.1)
- ❑ Air quality permit conditions (Section 8.2)

Example Situation: Not applicable to this section of the manual.

Example Action: Not applicable to this section of the manual.

Notes: ______________________________

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8.1 MISCELLANEOUS UNITS

Regulations: 40 CFR Parts 264 Subpart X, 270.23, and 270.27

Guidance: No specific references are applicable to this section of the manual.

Explanation: Types of miscellaneous units commonly associated with hazardous waste combustion facilities include drum shredders and waste feed preparation devices (such as pug mills). The following is a discussion of typical permit conditions for miscellaneous units.

Permit Conditions: Regulations for Subpart X units provide that the units conform to performance standards that are protective of human health and the environment and the same basic closure, postclosure, and financial assurance requirements applicable to other units at the site.

Typical permit conditions for miscellaneous units are as follows:

- <u>Permitted and prohibited waste identification</u>. A list of acceptable and prohibited wastes is provided
- <u>Design and construction requirements</u>. Compel the permittee to design and build the facility in accordance with applicable design standards and approved engineering drawings and specifications
- <u>Operation and maintenance requirements</u>. Compel the permittee to operate and maintain the facility in accordance with approved procedures, usually those provided in Section D of the permit application
- <u>Performance standards</u>. The U.S. EPA specifies the performance standards, including waste treatment efficiencies and emissions limits
- <u>Performance test</u>. Requires the permittee to test the unit to demonstrate compliance with approved performance standards
- <u>Waste Feed Limitations</u>. Restricts the rates at which the permittee may feed wastes to the unit
- <u>Operating conditions</u>. Compels the permittee to maintain certain operating parameters within finite limits
- <u>Monitoring requirements</u>. Specifies the manner in which the permittee must monitor and record process operating and emissions data

- Waste feed cutoff requirements. Compels the permittee to install and operate a system that automatically interrupts waste feed in the event that certain operating conditions deviate from set points prescribed by U.S. EPA

- Financial assurance for corrective action. Requires the permittee to maintain financial assurance for the corrective action

Example Situation: The ANCDF facility operates a brine reduction area—comprised of two evaporators, a heat exchanger, and two drum dryers—as part of the combustion unit APCS system (see Attachment Q). These units are not typical of hazardous waste combustion units and need special permit conditions.

Example Comment: In the ANCDF permit, Clark includes permit conditions for these units (see Attachment Q).

Notes: ____

8.2 AIR QUALITY PERMIT CONDITIONS

Regulations: 40 CFR Parts 270.23 and 270.27

Guidance: No specific references are applicable to this section of the manual.

Explanation: In some instances, a joint RCRA and CAA permit may be issued. An example might include a boiler that requires a RCRA permit to burn hazardous waste and a CAA permit to satisfy Title V permit requirements for major sources regulated by a New Source Performance Standard.

Permit Conditions: It is important for the permit writer to review existing or proposed air permits and to consult with regional offices, field offices, inspectors, toxicologists, stack testers, and other permit writers for air to reduce the potential for conflicts between the RCRA permit and the CAA permit.

The specification of permit conditions is coordinated with cognizant air quality personnel. Typical permit conditions for CAA portions of the permit are as follows:

- General air quality conditions. Specify for regulatory requirements (air quality) for unit design, construction, and operation.

- Emissions limits. Specify for limits on emissions of PM, acid gases, and other hazardous air pollutants.

- Sampling and monitoring requirement. Compels the permittee to implement a prescribed program of air emissions sampling and monitoring.

- Recordkeeping and reporting requirements. Require the permittee to record sampling and monitoring data in a specific manner and mandates that certain types of data be reported to U.S. EPA according to a prescribed schedule.

Example: Refer to Section V of the TXI draft RCRA permit (see Attachment R).

Notes: ____

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9.0 CORRECTIVE ACTION REQUIREMENTS

Regulation: 40 CFR Parts 264.101(b), 264.552, and 264.553.

Guidance: No specific references are applicable to this section of the manual.

Explanation: U.S. EPA is required to specify corrective actions for SWMUs in the permit. The complexity of permit conditions for corrective action is entirely site-specific. The U.S. EPA 1994 guidance RCRA Corrective Action Plan assists in developing site-specific requirements for permitting. It provides an overall model for the corrective action process, but the information should **not** be considered boiler plate language. The model scopes of work should be modified with site-specific information, and **only the information that is necessary for the subject facility should be required** to minimize the number and length of submissions and corresponding agency reviews.

It is a good idea, when possible, to specify in the permit what the performance standard will be for the facility. This may be source removal, on-site stabilization of all ground water releases, elimination of off-site releases, or control of other possible exposures to affected populations. This should be coupled with a time frame for reaching the goals (for example, 2 years or 30 months).

Permit Conditions: Required permit conditions related to corrective action include the following:

- Authority. Provides a citation of statutory and regulatory authorities completed in accordance with 40 CFR Parts 264.552 and 264.552.
- Financial assurance for corrective action. Requires the permittee to maintain financial assurance for completing the corrective action
- Schedules. Requires the permittee to include schedules of compliance for corrective actions; unless actions can be completed prior to issuance

Possible permit conditions related to corrective action include the following:

- Identification of SWMUs. Presents a SWMU listing from a site-wide perspective
- Stabilization or emergency removal. Compels the permittee to conduct stabilization or emergency removal in the event that imminent dangers to human health or the environment are encountered

Example: In the AGC permit, Lois included comprehensive permit conditions for corrective actions covering 24 SWMUs and four AOCs (see Attachment T). Lois made sure that the permit conditions included performance standards and specific schedules to implement these performance standards.

Notes:

10.0 CLOSURE AND FINANCIAL ASSURANCE REQUIREMENTS

Regulations: 40 CFR Part 264 Subpart G

Guidance: U.S. EPA. 1990. "Draft of Guidance of Incinerator Closure." OSWER. October 30. Pages 1 through 8.

Explanation: The permittee is required to close the facility at the end of its useful life, in accordance with the approved closure plan, and to maintain financial assurance for closure throughout its active life and the closure and postclosure periods. In certain instances, for example with boilers or cement kilns, these units may be closed by decontaminating the units and certifying closure, after which they can be operated using fossil fuels or nonhazardous wastes.

Permit Conditions: Possible permit conditions related to closure and financial assurance include the following:

- <u>Financial assurance</u>. Requires the permittee to maintain a specified amount of financial assurance.
- <u>Closure schedule</u>. Describes when closure must begin and the timeframe in which it must be completed.
- <u>Closure notice and certification requirements</u>. Requires the permittee to provide written notice of closure commencement and to certify that closure proceeded in accordance with the approved closure plan.
- <u>Closure requirements</u>. Specify performance standards and technical aspects of the required closure for various hazardous waste management units at the facility.

Examples: In the TXI draft RCRA permit, Clark included comprehensive permit conditions for closure and financial assurance at a hazardous waste-burning cement kiln (see Attachment S).

Notes: ______________________________

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11.0 CASE STUDY—CONSOLIDATED INCINERATION FACILITY

Background: CIF is a new incineration complex designed to burn a variety of liquid and solid radioactive mixed wastes. The design includes the following systems:

- A tank farm for liquid waste storage and blending
- A container storage area for solid wastes
- Feed systems for liquid and solid wastes
- A rotary kiln incinerator (PCC)
- A SCC
- Quench chamber
- Free-jet scrubber
- Cyclone separator
- Mist eliminator
- Off-gas reheater
- Bank of HEPA filters
- Three induction fans
- Exhaust stack
- Ash solidification system

The process is controlled by a computerized distributed control system.

Permit Conditions: Permit conditions for process operating parameters required by SCDHEC in the four-phased permit for this facility have been superimposed on the process schematic (see Attachment W).

Example: In the CIF permit (see Attachment G), Lois and Clark included Group A, B, and C parameters, as follows:

<u>Group A</u>

- HHV waste feed rate

- LHV waste feed rate
- PCC temperature
- SCC temperature

Group B

- Metals feed rates

Group C

- PCC pressure
- SCC pressure
- PCC heat release
- SCC heat release

Notes: